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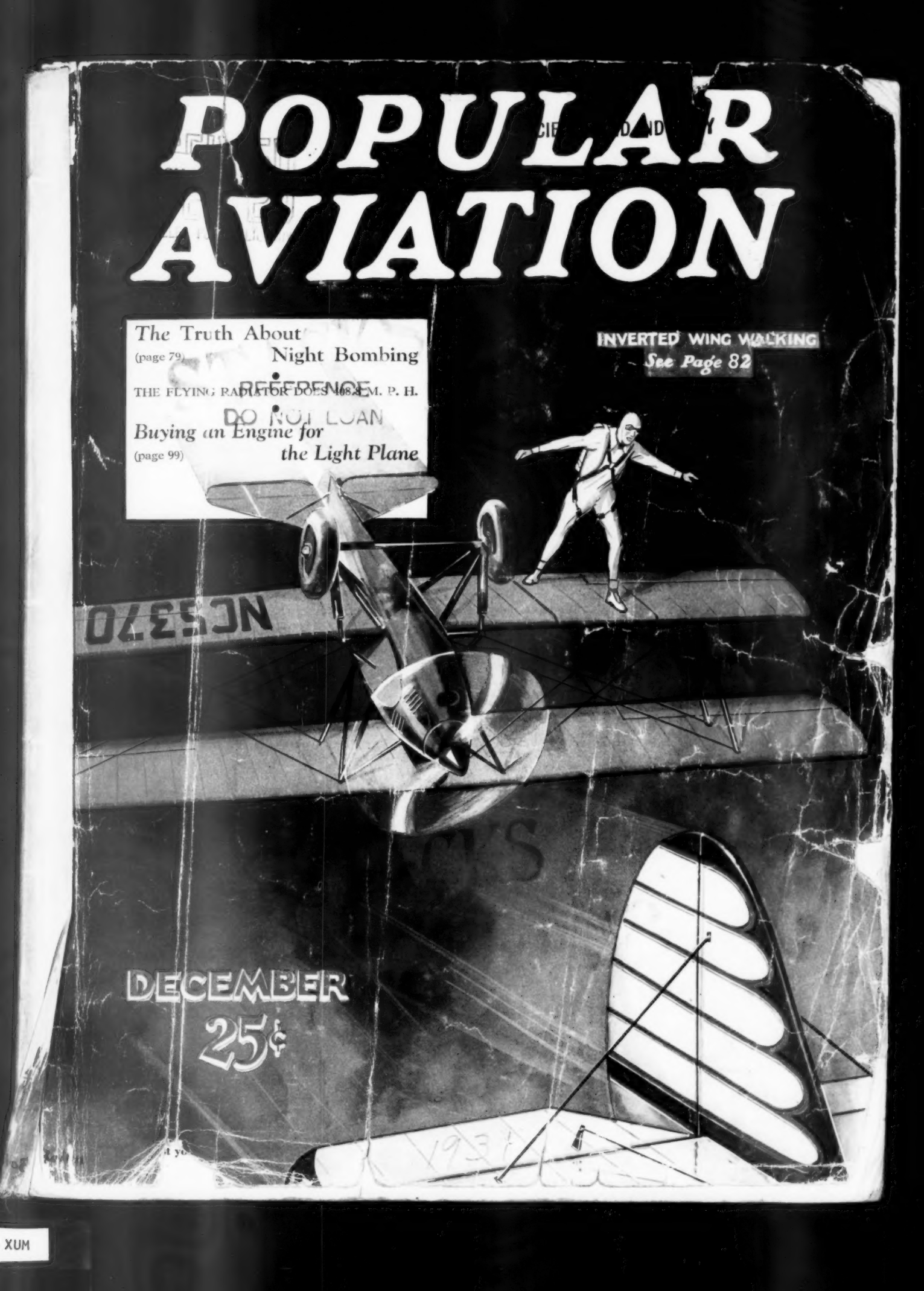

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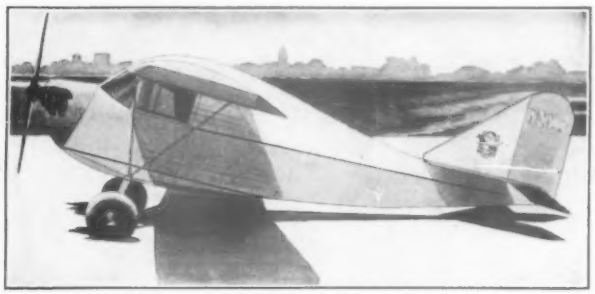

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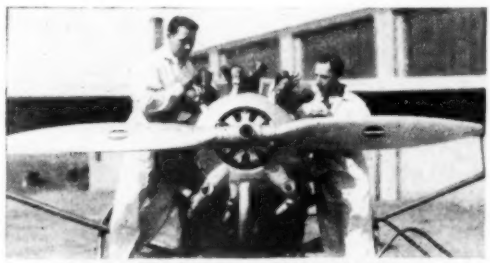

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LINDBERGH LEARNED

An Airy Chat With the Editor

A MERRY Christmas to all of our readers, and particularly to those who regularly patronize the Airy Chat column. We expect that you will have substantial remembrances during this season, aeronautically speaking, as well as otherwise, although we must confess that an airplane or a glider is a tight fit in even the most commodious stocking.

We have seen some ships go down chimneys, it is true, but they were far from being accompanied by the essential spirit of the Yule Tide, nor were they remarkable for the blithesome carolings of the pilot as he picked himself off the hearth.

* * *

AS time goes on, and as we read the hundreds of friendly letters that come pouring into the office, it pleases us that POPULAR AVIATION has become something more than simply a magazine. It seems to us more like one big family or club having many thousands of members, bound together by common interests and mutual goodwill.

This is as it should be, and we are greatly elated over the trend in this respect. We are glad that we have succeeded in establishing the personal spirit among you as has been proved by the many friendly and even chummy letters that have been received. Therefore, we ask you to gather about our family circle and make yourself one of us, so that we can discuss things among ourselves, pro and con, in a perfectly familiar and natural manner.

We believe, here at the office, that if we make as much progress during the coming twelve months as we have made during the past year, that POPULAR AVIATION will come very close to meeting our ideals—and yours.

* * *

THERE has been a big change in the subject of the war story in this issue—we hardly need to tell you that—but you will find it extremely interesting if only for this reason. It is an extremely well written article, setting forth the personal experiences of the writer, Walter A. Heinsen, who was an observer in the German air forces during the war. And then, this story carries the thrilling episode of a bombing expedition over London by a German bombing squadron, which is as certain to raise your hair as it did ours. Accompanying Heinsen's yarn is an unusual photograph of a dugout.

* * *

AND then we get back to the British Super-Marine which has added further laurels to its brow since the last issue. Flight Lieut. Boothman capped the climax by flying 388.6 miles per hour on the day of the Schneider Trophy race, but later on, they revamped the old ship so that the official speed reached 408.8 miles per hour.

This story is told in this issue, but we failed to include one interesting feature that deals with the physical condition of the pilot during the race. It is said by authorities at the race that Flight Lieut. Stainforth "went out" completely at every turn around the pylons, due to the fact that the tremendous centripetal force literally drove the blood out of his brain for a few seconds. His body was cut and bruised by the same force—driving his body against the walls of the cockpit.

* * *

CAP PURCELL, as usual, comes back with some mighty good stuff on the daily life of a Department of Commerce inspector. Purcell's articles are so intimate, and so thoroughly hooked up with flying practice, that you can almost hear the engines roar when he writes.

Being an inspector, according to the Captain, is far from being a bed of roses. In fact, it seems that it were largely a bed of thorns. From flying a ship of new design and unknown performance, down to giving a student his examination for his license, are all included in a day's work that involves very frequent "bailing out." Read it, and enjoy the harrowing details.

* * *

IT would certainly surprise you to discover how many war-plane picture collectors that we have in our midst, but at a low estimate, these fans total several hundred. One war-plane fan, visiting at the office, modestly admitted that he had 750 war-plane pictures while his companion, with a crestfallen air, lamented that he only had 500 photos! What do you think about that?

* * *

IT'S a funny thing, but many airplane fans forget about or ignore the engine in the ship. All their attention seems to be centered upon the wings and fuselage. Now, as you will all admit, the engine is the heart and soul of the whole rig. It is for this reason that a number of our readers have risen up in their seats and demanded more engine dope, and being of the same mind, this is just what we are going to give you from now on. The engine is the most human of all the many elements that go to make up an airplane, and if you have no leaning toward aeronautic engines at the present moment, we're sure that you will have.

* * *

TALKING about engines, reminds us of a letter received from Lurlin Collins of Cedar Rapids, Ia., who very vigorously defends the employment of a Model "T" Ford engine as a motive power for airplanes. He writes thusly:

In the September issue of your magazine, I read the "Question and Answer" comment regarding the conversion of the Model "T" Ford motor, and after my experience with it, I don't think it was given a fair answer.

The motor that I used was made up in this manner. The transmission was removed—of course. A Giant High Power cylinder head was secured from a mail-order house, a set of Bohnalite pistons and steel valves used, together with a special pan holding four quarts of oil.

An oil pump was fastened where the generator used to be, and a half-inch line was run on the side with quarter-inch lines spraying oil on each bearing. An anti-clockwise magneto was also fastened on a bracket at the end of the crankshaft.

This motor turns a six foot prop at 1,875 r.p.m., and at this speed, we feel that between 35 and 40 h.p. is developed. The motor weighs 190 pounds dry, so you see that this isn't so heavy for a motor of this type. When I flight tested this motor, it was only turning 1,800 r.p.m. This ship was built for a much more powerful motor, but I got it off the ground and flew it for about 15 minutes.

The oiling system was not so good as it is now, so the motor got hot and parked me in a plowed field. However, we have rebuilt it, so I feel certain, if hooked up with a Peitenpol design

(Continued on page 116)

XUM

POPULAR AVIATION

A Magazine for the Promotion of Amateur Aviation and Private Flying

Volume IX DECEMBER, 1931 Number 6

TABLE OF CONTENTS

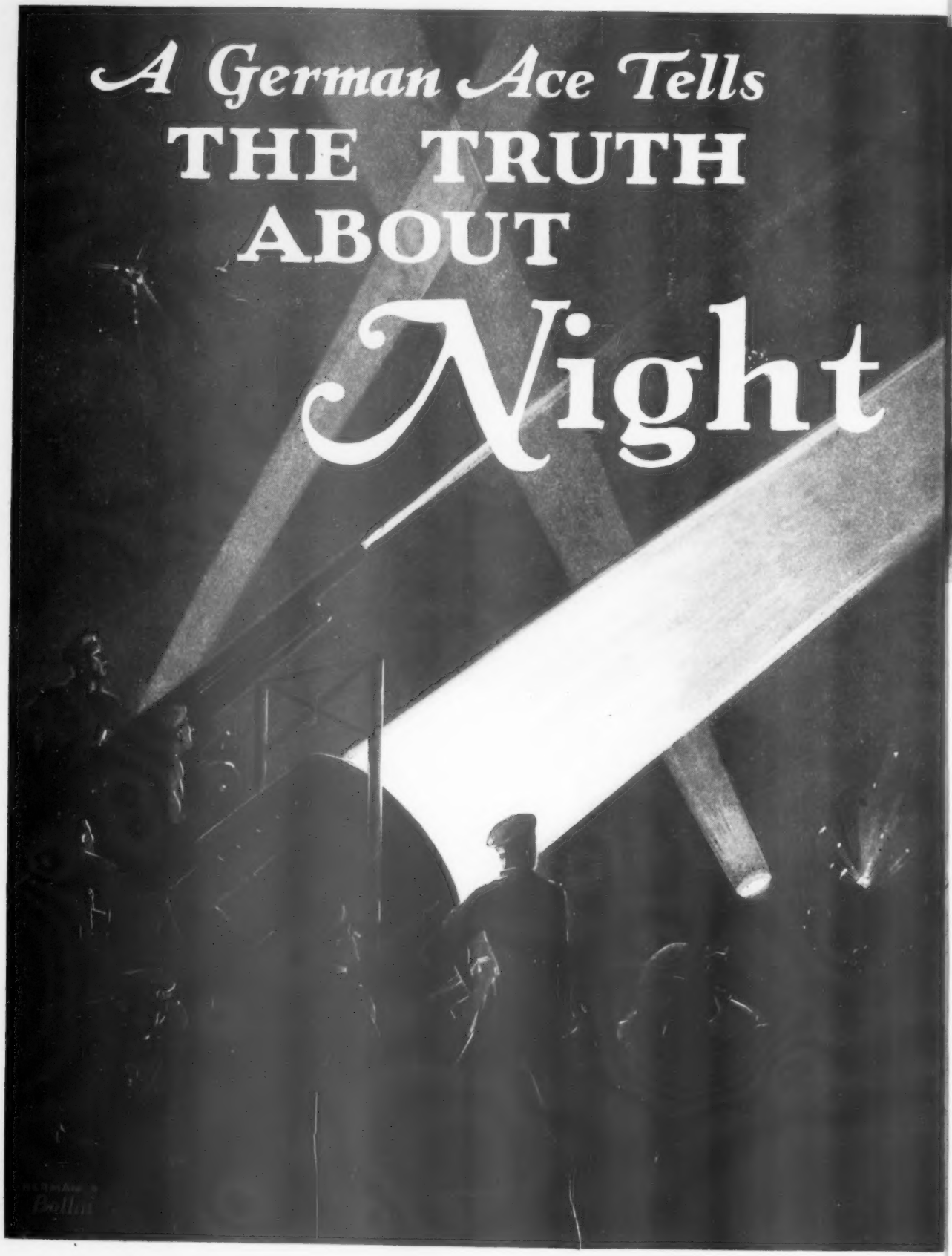
FEATURE ARTICLES

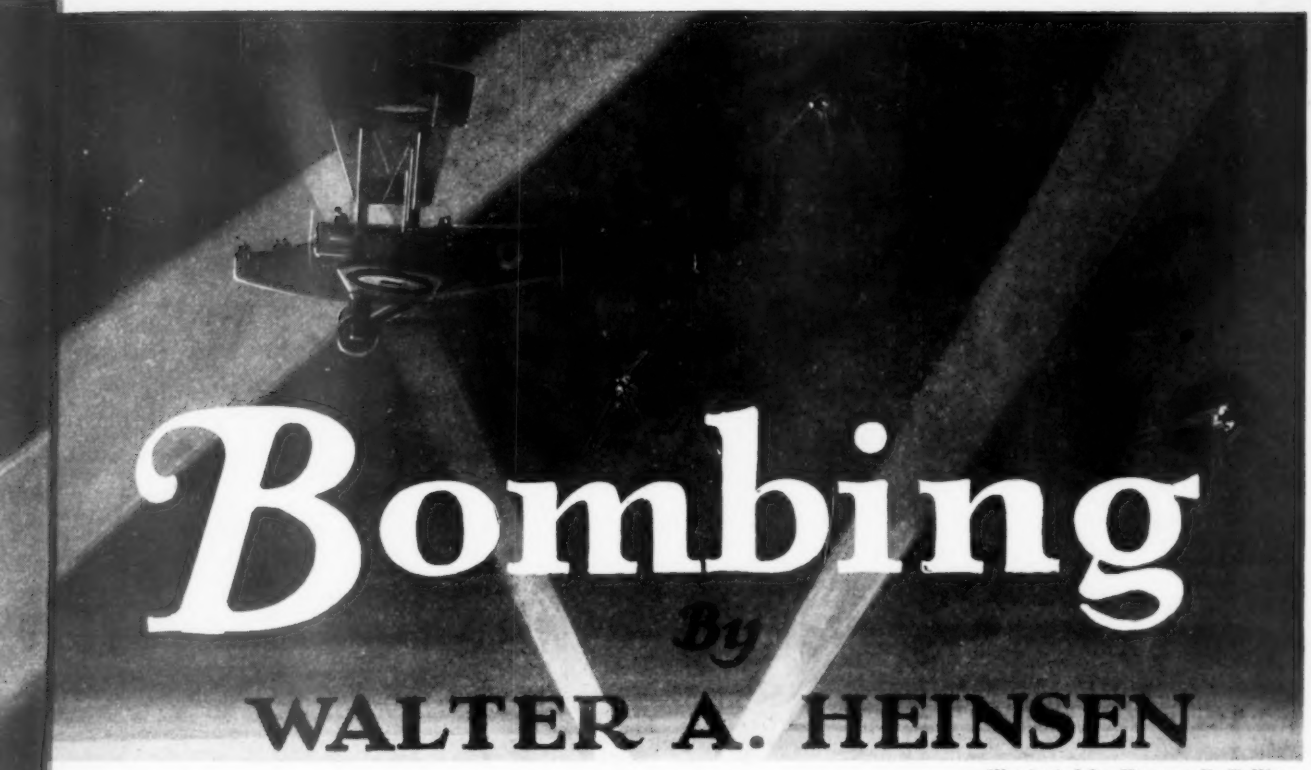
An Airy Chat With the Editor 76
A German Ace Tells the Truth About Night Bombing 79
Monster Boeing Bomber is Unique 81
Let's Pin a Medal on the Inspector 83
The Flying Radiator Does 408.8 M.P.H. 85
Edward Heath—An Appreciation 86
An Airship Goes Out for a Walk 87
Glider Notes for the Novice 91
Junior Activities 94
Freddy Lund—Exhibition Thriller 95
Buying an Engine for the Lightplane 99
Question and Answer Department 101
The Gypsy Moth and Puss Moth Planes 103
Russian Reefing Wing Ship Completed 104
Practical Lessons in Flying 105
Famous Planes of the World War 107
The Round Robin Club 108
Model Department—Building the Super-Marine 110
Women's Activities 114

THE PICK OF THE BRIEFS

Dirigible Service for New York 80
Gravity Controlled Altimeter 81
Gust Recorder Devised for Dirigibles 81
Walking on Inverted Wings 82
Gee-Bee Supersportster 82
Air Transport Lines of the United States 84
Edward Heath Memorial Completed 86
Naval Officers Study Parachutes 86
No Aces Required for Next War 88
Some Pilots I Have Met 89
Details of the Giant Sikorsky 89
Air Propelled Boat Skims Over Danube 90
Twentieth Anniversary of Air Mail 90
French Glider Pilot Warns Comrades 92
Yes, We Like Gliders 93
Spring Skids Absorb Landing Shocks 94
Boy Scouts Organize Eaglerock Glider Troop 94
Flies Into Baby Tornado 96
Rocket Driven Glider is Successful 97
Model Tests in College Wind Tunnel 98
New York Has Air Cops 98
True Tales From the Hangar 103
Gypsy Moth and Puss Moth Planes 103
Challenges the Autogiro 104
Kellett K-2 Autogiro 109

POPULAR AVIATION. Volume 9, Number 6. Published monthly by Aeronautical Publications, Inc., at 608 South Dearborn Street, Chicago, U. S. A. William B. Ziff, Publisher, B. G. Davis, Editor, John B. Rathbun, Managing Editor. New York Office, 551 Fifth Avenue, New York City. Subscription $2.50 per year; single copies, 25 cents; foreign postage, $1.00 per year extra. All contributions paid for at regular rates, but the publishers can not be responsible for the loss of any manuscripts or material submitted. Entered as second-class matter, June 16, 1931, at the Post Office, Chicago, Ill., under the act of March 3, 1879.


A German Ace Tells
THE TRUTH
ABOUT
Night



Bombing

By

WALTER A. HEINSEN

Illustrated by Herman R. Bollin.

Heinsen, formerly an observer in the German Air Forces, graphically describes a bombing raid on London in which he participated. How the raiders were trapped by the searchlights, and how the English revenged themselves is an interesting bit of reading.

THE NIGHT is dark. I am standing at my window. Far to the south of me the Lindbergh Light, largest in the world of its kind, is cutting its way through the blackness in a dazzling friendly manner.

It fascinates me and fills me with an indescribable feeling, for it brings back memories . . . memories of other nights and other searchlights . . . big German searchlights relentlessly sweeping the sky for the hostile bombers known to be lurking somewhere above . . . huge, unfriendly British searchlights hunting for us . . . hunting for me. . . .

Never can those nights be rivaled for sheer drama, thrills and awfulness. Even were it possible, I would not part with those glorious memories for a thousand dollars.

* * *

WE ARE at the German airdrome at Ghent, Belgium. It is the largest and one of the most important of the Kaiser's aerial bases and is located on the outskirts of the city. From four to five thousand men are sometimes stationed here, which will give you an idea of its size. It is here that our airplanes are rushed to be assembled. It is here that the German flying cadets receive the finishing touches to their training.

It is the headquarters for countless squadrons of bombing and combat planes. It is here that the enormous Gothas, used for invading England, are kept. In fact, it is of so much importance that the British bombers visit us regularly and shower us with unwelcome tokens of their hatred.

Night has long since fallen and we are asleep in the halls or barracks equipped for that purpose. Each of these long, narrow halls is furnished with two tiers of bunks. Also, each is furnished with a siren that sounds an alarm whenever hostile planes start coming our way.

Eleven o'clock arrives—and our siren suddenly commences its hideous shrieking. Most of us tumble out of bed but there are a few, who, too exhausted to care, merely swear and roll over.

Rushing outside, I find the field in absolute darkness. Woe to him who strikes a match or puffs a cigarette now! Hundreds of men are scurrying underground for safety. And, of course, this is the sensible thing to do but I am too thrilled by the goings-on about me to follow their example, so I join one of the quiet groups who are watching the sky. Far above us, the hum of enemy motors is becoming audible.

For obvious reasons, the big searchlight and batteries of anti-aircraft guns which protect our airdrome are not in too close proximity to us. I doubt whether any of them are within a half mile of the borders of our field. These lights are now racing back and forth across the sky, frantically seeking for our visitors. It is a wonderful night.

Suddenly, one of them catches a British bomber in its glare and several other lights immediately swing over on him in an attempt to prevent his escape. As they do so, he releases all his bombs in order to lessen his weight.

Then hell breaks loose! Anti-aircraft batteries, artillery and machine guns start pumping metal and explosives at him from all directions and with all the speed and fury they can muster. The air about him is alive with dull roars, sharp crashes and lightning-like streaks of yellow flame. They are hurling everything at him except their old shoes and best wishes, and we watch spellbound as he ducks, dives and twists in an effort to elude the merciless shafts of light that point him out to the ground batteries.

In the meantime, another searchlight has picked up a second plane, and again other lights scurry over to hold him. Down comes his entire load of bombs as he turns and flees like a naughty schoolboy who has just been caught in the act of trying to rob an apple orchard. The lights, to say nothing of a plentiful amount of bursting shells, follow him as he speeds away. Unfortunately for us, the eggs he dumped are not wasted. Crashing down, near the far end of the field, they destroy enough hangars and planes to make us wish him all sorts of bad luck.

His bad luck arrives an instant later. A small, dirty-looking puff of smoke

appears directly in front of him. He rocks crazily for a moment, then, with a tail of red fire in his wake, he tumbles downward like a falling comet. The lights, no longer interested in him, swing away and search for other bombers. Evidently there are plenty of them, as the occasional explosions in our vicinity have been testifying.

And now unpleasant things are happening upon our field, so we desert the thrilling scene and hurry underground. For let it be known, a greater danger than the British bombs has been menacing us as we watched. As you can readily imagine, whenever the searchlights pick out a hostile flyer above us, our ground batteries throw about fifty times as much explosive material at him as he is actually carrying.

And, if you will pardon the use of the motheaten proverb, "What goes up must come down." It has been raining various sized bits of metal for the past several minutes, and I assure you that these fragments of shell, dropping from a height of a mile or so, have never been known to improve the health of whomsoever they strike.

And so we sit underground, where we can smoke, and listen to the various noises above us. Some of our men are grinning and enjoying it immensely. Others are quivering with excitement. Some have fear written across their features.

"They have come from Poperinghe," one of the men remarks. (Poperinghe is a tiny Flemish town where the British have an airdrome of similar size and importance.) "They are retaliating for the visit we paid them last night." Then, as a dull boom is heard —"There goes another hangar!"

Finally, all noise dies away. The thing is over. Wearily, we come out of our holes, return to our barracks (those that are still intact) and crawl into our bunks. Several minutes pass. Loud snores begin to disturb the silence. The happenings of an hour before are forgotten.

* * *

ANOTHER night—and the airdrome is the scene of much activity. Men are hurrying this way and that. The big Gothas are being rolled out of their hangars. They are going over to England to drop their monstrous bombs and put a few more grey hairs in the heads of the family residing in Buckingham Palace.

Clumsy, awkward-looking things, these Gothas, with their great wingspread and fat bodies. I can't make up my mind just which they resemble most—an overfed crow or an elephant with wings. When they return to the field after a flight, they don't seem to *land*—rather they seem to *squat*. They are not exactly speedy, but they have great lifting power.

Wicked looking torpedo-like bombs are being placed into position, the pilots and other members of the crews (each Gotha usually carries a pilot, an observer and two men to release the bombs) are donning their flying togs, and the engines are being warmed up. The preparations for this trip are fast yet methodical and precise. Soon everything is in readiness.

A signal is given. Down the field comes a squadron of the gigantic planes, bumping and thundering over the ground. Then, as though with an effort, they rise and roar away in the dusk. They are followed closely by another squadron. And another. Eventually, the sound of their motors dies away in the distance.

To most of us who have remained behind, the privilege of retiring for the rest of the evening, or loafing if we prefer, is extended. But, for a certain group of one hundred and fifty men, the night holds further duties and plenty of danger.

These are the men who have been selected to await the return of the Gothas, light the flares which illuminate the field and guide the winged elephants to a safe landing. It sounds like a comparatively safe and uneventful task—but it isn't. On the contrary, it has become so hazardous (especially of late) that nobody is inclined to wax enthusiastic when informed that he has been selected for the job.

Time passes slowly, but at last we hear the humming of engines. The Gothas are returning. Signals are flashed and answered. Commands are given, and a few minutes later the flares are burning brightly. We, who are taking no part in work are behaving rather strangely. We are staying close to the entrances to the underground shelters.

The huge bombing planes are commencing to land. Down they come—like tired fat men—and squat. Sud-

(*Continued on page* 117)

+ + +

The bomb-proof dug-out in which the German officers took shelter at Ghent during the bombardment.

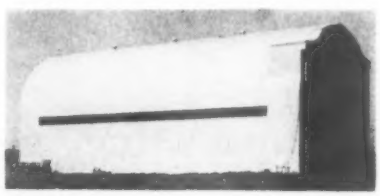
+ + +

Dirigible Service for New York

WITHIN fifteen minutes of Times Square, New York, and almost in the shadow of the skyscrapers of Manhattan, a dirigible hangar is being completed at Holmes Airport, which will bring a daily dirigible service directly into the heart of the metropolis.

The hangar is of steel, 200 feet deep, 96 feet high and 88 feet wide. It is large enough to house the Defender, flagship of the Goodyear-Zeppelin Company's fleet, which is to use the airport as its eastern base.

The primary object of establishing the service is to educate the public to the comfort, safety and pleasure of airship travel, preparatory to the regular trans-Atlantic dirigible service, which Dr. Hugo Eckener has said will probably be inaugurated in 1933.



The New York dirigible hangar.

One of the big blimps of the Goodyear fleet is to fly from the airport daily, for sightseening, training and weather study. When the weather permits, there will be night flights and the service will be operated eighteen hours daily. Three complete dirigible crews and a corps of mechanics will be stationed at the base.

The Defender has been operated from the airport three times previously, the first time on Sept. 6, 1929, when it made forty trips over the city and carried more than 300 passengers. Each time it attracted large crowds. As the hangar neared completion, the blimp Columbia was sent to the airport and began a series of training flights and landings at the field.

The airport, operated by E. H. Holmes, was made largely of subway fill. More than 400,000 cubic yards have been poured into the tract.

Flying Relieves Eye Strain

FLYING, as a remedial agent in cases of eye strain, is advocated by Dr. Harold G. Stafford. The beneficial effect of looking out on the horizon, when at the seashore or on shipboard, has frequently been noted in connection with certain affections of the eyes. Dr. Stafford holds that travel by air is even more beneficial, due to the fact that the horizon is not always clearly defined and presents few definite forms on which the eye may be focused.

According to Dr. Stafford, the fact that the flying passenger is moving and that the scenery is ever changing eliminates the possibilities of cramping the eye muscles. It is not contended that air journeys will effect cures, but that flights will afford definite rest.

XUM

A Gravity Controlled Altimeter

A NEW altimeter, which will eliminate some of the dangers of fog, was recently demonstrated at the Templehof Airdrome in Berlin. This new invention indicates the altitude of a plane above the ground instead of above sea level. This will make it possible for a pilot to fly through fog without the danger of striking hills or mountains.

The new device operates on the theory that matter loses weight in proportion to its increasing distance from the ground. The altimeter now in use indicates altitude by registering air pressure, and is subject to varied weather conditions.

The new altimeter is the invention of an Austrian inventor by the name of Hans von Braun, and is the result of three years research. The model demonstrated, consisted of a pendulum which makes a constant number of revolutions. As the plane rises, the pendulum becomes lighter and the revolving circle widens. This pushes up a small cylinder, which in turn operates the scale indicator. It is so sensitive that every elevation of the ground is indicated on the scale. It is claimed that this new invention will register high buildings according to the bulk of their materials.

Jimmie Tate, 'Chute Packer

THERE is one air enthusiast who could easily form his own Caterpillar Club of fliers he has helped to initiate. He is Sergeant Jimmie Tate, popular member of the 35th Division, Missouri National Guard, stationed at St. Louis.

Nine airmen have leaped to safety with parachutes packed by Sarg. Tate. Among them is our Colonel Lindbergh, who has twice climbed over the side of the cockpit with nothing but one of Jimmie Tate's chutes between him and crashing death.

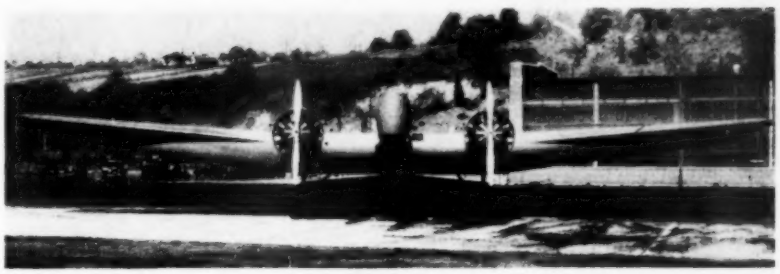
Others on the club roster are Captain Fred Nelson, noted army pilot, and Casey Lambert, one of our wealthiest flying men. A ninth and prominent name was recently added. It is that of Major James H. Doolittle. The Major was testing at an altitude of only 300 feet when his motor went dead, and he was forced to float to earth under a Tate packed canopy.

A Stratospheric Airplane

AN airplane, believed capable of flights into the stratosphere ten miles above the earth, has just been developed by Junkers in Berlin, Germany, and will receive its first tests before the snow flies.

The stratospheric plane has been built for scientific purposes. Outwardly it differs from ordinary airplanes only in that its wings are larger and its lines more slender, presenting the appearance of a giant flying triangle with a breadth of 92 feet.

Monster Boeing Bomber Is Unique



A front elevation of the Boeing monoplane bomber recently supplied to the Army Air Corps.

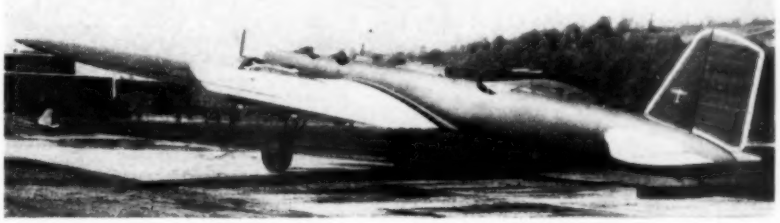
THROUGH the four years of the war, and then after the war, we have learned to visualize a bomber as an overgrown biplane. Time and manners change, however, and here we have the latest thing in bombers, the Boeing all-metal bombing plane being built for the Army Air Corps.

Seven of these bombers have been ordered by the Army Air Corps at a cost of nearly $700,000. A price of $100,000 per ship is a whole lot of money, but if the necessity arises, they are well worth it. The bomber carries a crew of five men and two 1,000 pound bombs, and while the official figures on the performance have not yet been released, it is generally known that these bombers are substantially faster than any type of bombing plane built up to date.

The wing span is 76 feet and the ship is powered with two Hornet wing engines, well protected with ring cowls. The landing wheels are of the retractible type, and when lifted up and out of the way in flight, very greatly reduce the resistance so that a material increase in the speed is attained. The front view shows unusually clean lines and almost an entire lack of extending parts in the wind stream.

One thing that is an outstanding feature of these bombers is the unusually long, thin fuselage—about the proportions of a panatella cigar—a feature that not only reduces the wind resistance but which also gives a more favorable distribution of the personnel. The front view also shows the exceedingly thick wings necessary with this ship.

Bomber viewed from the rear, showing the unusually long slender fuselage.



Gust Recorder Devised For Dirigibles

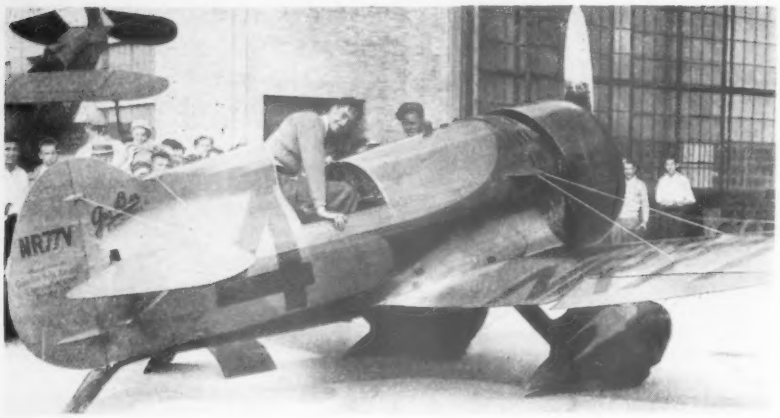
A GUST - RECORDING instrument, adapted from the common cup anemometer by C. F. Marvin, Chief of the United States Weather Bureau, is proving useful in maneuvering the dirigible Akron in and out of its dock.

Exact knowledge of the air movement is extremely important in deciding when to take-off and when to land with lighter-than-air craft. The Akron's navigators, therefore, are vitally interested in the velocity of the wind at all times, as well as in the performance of their ship under different wind velocities, as recorded by the new anemometer during each flight.

The modified gust-measuring mechanism consists essentially of an anemometer with three aluminum cups set up on the roof of an observation tower. It is connected by wires with a recording device in a room below. A magneto, attached to the axis of the revolving system of cups, generates a current of electricity that varies directly with the speed at which the cups are spun by the wind. This electrical current moves the pen on a band of paper which passes along fast enough to record, in full detail, each momentary oscillation of the wind.

An ordinary anemometer, Professor Marvin found, will not fill the modern need because the cups are too heavy, causing some lag and loss of time in their response to changes in wind velocity. Very light paper cups proved satisfactory under laboratory conditions, but they were not durable enough to stand the stress and strain of actual use under outdoor conditions. Cups made of aluminum proved satisfactory, as they are light, turn quickly, and register variable velocities effectively.

Gee-Bee Super-Sportster Makes Speed



View from the rear of the "Gee-Bee" Sportster.

ONE of the most popular machines at the Cleveland Air Races was the "Gee-Bee" racer. This short stubby little ship won the Thompson Trophy race at the speed of 236.24 miles per hour, which was quite a remarkable speed for the engine power installed. In response to the requests made by many of our readers, we are reproducing a photograph of the ship.

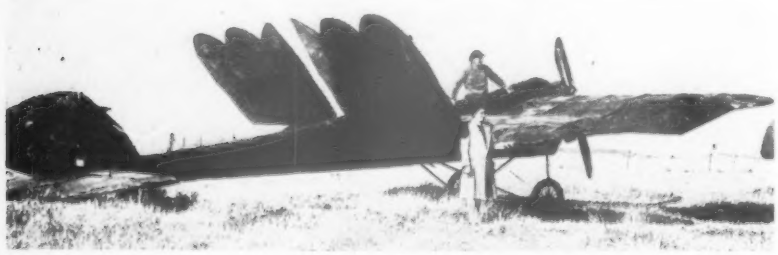
As will be seen, the fuselage and the wings are both short and stubby. In order to reduce the length, and to improve the streamlining, the tail group has been placed in a rather unusual position. While aerodynamic theory dwells long and lovingly upon the benefits of a large aspect ratio, the aspect ratio of these wings is quite low—and yet they rendered an excellent account of themselves.

It is quite interesting to note the relative performance and horsepower of the "Gee-Bee" and the English Super-Marine. The Super-Marine carried an engine having approximately four times the horsepower of the "Gee-Bee," yet it did not go even twice as fast! This indicates the rapidity with which the air resistance picks up at very high speeds. The "Gee-Bee" ran with an air-cooled engine, while the Rolls-Royce on the Super-Marine was water-cooled and required practically all of the ship's surface to get rid of the heat.

SPECIFICATIONS

Wing span	33 ft., 6 in.
Wing area	75 sq. ft.
Wing loading	30.2 lbs. per sq. ft.
Length overall	15 ft., 1 in.
Engine (Wasp)	525 h. p.
Gross weight, fully loaded	2,280 lbs.
Power loading	4.26 lbs. per h. p.
Top speed	270 miles per hour
Landing speed	80 miles per hour

German Turkey Plane Claimed Stable



German "Turkey Plane" showing the large dorsal stabilizing fins.

THE accompanying photograph shows a novel plane which was recently demonstrated in Germany. It is called the "turkey plane," and its construction permits a takeoff at a sixty-degree angle. It was designed by Herr Joseph Sporrer, who also introduces a device which prevents the plane from falling in a nose dive should the pilot lose control of the craft.

Bombs Fail to Sink Shasta

DESPITE an hour's deluge of more than 8,000 pounds of high explosives, the old steamship Mount Shasta remained afloat after army air bombers attempted to sink her in maneuvers off Cape Henry, Virginia. Shell fire from the Coast Guard cutter Carrabasett finally sent the boat to the bottom of the Atlantic Ocean. This test shows that not one of the aerial bombs found its mark on the Mount Shasta.

Walking On Inverted Wings

(See front cover)

WHEN the first wing walker carefully worked his way out along the lower wing, holding carefully to the interplane struts, he was greeted with tumultuous applause. When this act grew stale, then he progressed to the point where he sauntered back and forth along the top wing without any handholds at all. And then came the plane-to-plane transfers and all the rest of the acrobatics, but all of these tricks were performed with the plane in its normal flying position.

Now, comes one Freddy (Bugs) Betz, an eminent wing walker, who goes the old time walking stuff one better. In short, he walks along the lower wing of the ship when it is in upside-down or in inverted flight, thus gaining additional renown. This stunt forms the subject for our front cover this month and we think the idea is striking.

While the ship is flying in its usual attitude, Freddy gets out of his cockpit and clambers down to the landing gear. Upon a signal from Freddy, the pilot turns the ship over on her back and then Freddy is in a position to stand up and take his stroll along the lower wing. Aside from its value as a circus maneuver, it would seem that this inverted wing walk had its practical phases as well. At least, it would permit a co-pilot to do a little work on the landing gear or wing struts before landing—and that would be something—sometimes.

Some Airplanes—What

AIRPLANES manufactured in the United States the first six months of 1931 totaled 1,606, of which 1,069 were for civil use, including 750 monoplanes, 277 bi-planes, 40 autogyros and 2 heliocopters.

Develops Steam Aviation Engine

A STEAM engine is being built in Chicago which is said to be much lighter in weight per horsepower than any heretofore developed. It is valveless, has no reciprocating parts and has no friction producing bearings. This engine is always in perfect running balance without use of counterweights and is therefore vibrationless.

It is not a turbine, and therefore can direct drive at moderate speeds without cumbersome reduction gearing. The maker claims that the upkeep will be less than one quarter the expense of maintaining other engines, and also that the fuel consumption per mile will be less than onehalf present fuel requirements.

Used as an airplane engine, the power plant (including boiler, fuel and water) would be approximately two-thirds the normal weight of a gasoline engine. Connected directly to the propeller shaft, and having full torque from the start, it is claimed that much shorter takeoff distance is needed, and the reliability of steam power will eliminate forced landings.

XUM

Let's Pin a Medal on the Inspector

by CAPT. CHAS. W. PURCELL

What, with trying out sausage maker's inventions and making flying tests on nitwit students, the inspector's life is just one jump after another.

THRILLS, death leaps, fire, and sudden death.

No, gentle reader, this is not a description of a new "movie." This is all in the average workday of an engineering inspector, Aeronautics Branch of the Department of Commerce. This little group of men gamble with their lives daily in order that some of you Palookas may live.

Not one youngster in a hundred thousand, who is flying today, realizes what an airplane must go through in order to get an Approved Type Certificate, nor does he realize that it may have been necessary for an Engineering Inspector to bail-out several times before the ship was safe to fly. These inspectors have been washed out several times in the process of test hopping these jobs, but that's all in the day's work for them.

When an application is made for an Approved Type Certificate, for a new design of airplane, technical dope on the plane in question is examined. When this has been found satisfactory, the real job starts—And what a job!

When we stop to think that these applications are made by everybody from horseshoers to sausage makers (and there are a lot of airplane manufacturers who should be sausage makers) then and only then, do we get some idea of the risk attached to this inspecting business.

The airplane is first tested for balance and then for stability—longitudinal, lateral and directional. All of this might sound a little too technical, so this part of the test will be skipped. The inspector only risks several broken bones, and maybe the sight of a couple of eyes in this test, but we can't be concerned with a little thing like that.

After the above items have been taken care of, the job of "spin testing" starts. If the inspector has a good luck charm, he probably gets a good hold on it at this stage of the game. He probably gives his chute-pack an extra pat to be sure it's there. He watches the stowing of the sand bags that are supposed to represent the passengers or payload, and when the gas and oil are in, he takes off.

He usually takes plenty of altitude for his first tests. Then, if he has any sense, he says a couple of "Now I lay me's" before he starts the spin. Finding a stall-point is easy on any ship and this is one of the department tests. From this he goes into a spin. With the first spin, his thrills for the day start—and how.

While the ship spins, the inspector must count turns. He counts the seconds it takes to make a turn, and sees that the spins are even and not jerky.

+ + +

An inspector about to take off for an altitude test flight on a new ship. This is the most hazardous work in aviation.

He is provided with a set of record sheets on which he makes his analysis. This includes data on spins and other dangerous maneuvers.

+ + +

Last but not least, he notes that the spin doesn't flatten out. Can you imagine doing all this and then wondering if the crock will come out when she gets the controls. (The author gets a pain in his neck just writing about it.)

When he has obtained all the necessary data from the spin, he moves the controls back to neutral—and nothing happens. How embarrassing! Then he reverses all controls to the extreme position and waits and then nothing happens. In the meantime, he must count seconds every time he touches the controls so that he'll know how long it took the ship to come out—if it does. This waiting, with the controls in reverse position and no change in the spin, must give him a creepy feeling up the middle of his back.

They usually allow eight turns with the controls in this position, and then try several others so that they can write a comprehensive report on the ship. The reader might think that two letters would make a good report on the ship—NG. No, sir, these inspectors are out to make this ship fly.

Sometimes the ship will tighten up in the spin and then it would take sixteen men and a couple of small boys to move the controls. The controls lock, due to back-pressure. He looks over the side, sees that he has several thousand feet left to him, and tries to get the controls loose. He cuts the gun, shifts his weight and gives it full gun. And when nothing happens he "bails."

He only "walks home" after he has tried everything he knows to get the ship out, and when he has just enough altitude for his chute to open—then overboard—if the spinning ship lets him get clear.

The inspector's troubles are not over yet. Getting out of a spinning ship is something for any one to write home about, especially when that ship has been in a spin for several thousand feet. The centripetal force of this type of spin tends to lock the pilot into the pit, and it is only through exerting every muscle in his body that he breaks free and sails out into space.

When he is out of the ship Old Lady Trouble still follows him. Maybe he has not thrown himself far enough when he and the ship are falling at the same rate of speed. If this happens he can not pull the rip-cord on his chute until he and the ship separate.

There would be little of the chute left by the time that the spinning wings got through with it. While he is waiting for this "separation" to take place, he may have to play "leap frog" with the wings or learn to duck when they come around.

IF THE inspector's time has not yet arrived, he gets away from the ship, pulls his cord and all's well with the world for the day—maybe. On landing, he might break a couple of legs or sit on the point of some church steeple, but that's all in the day's work.

It sometimes happens that when an inspector "bails out," after trying all of the above tricks, the ship will straighten out as soon as he leaves it. This usually brings down the sarcasm of the press on the shoulders of the inspector. They say the inspector left the ship too soon, that he knows nothing of flying, that he was "yellow" or any one of a thousand other remarks that would come from the mind of a nitwit who knew nothing of flying.

All pilots understand that a ship will sometimes come out of a spin when the pilot's weight is taken from the cock-pit of the plane in question. In certain types of planes, used by the Government for training purposes, the pilot, if he happens to be of extra heavy build, must stand up in the plane to get the ship out of a spin.

These ships are built with extreme balance. The balance is so fine that a few more pounds in the cock-pit, than the ship was built to accommodate, will overbalance the entire ship. When the pilot stands, he adjusts this weight to a normal position and the ship will come out of the spin without further work on the controls.

The reader may remember the crack-up of the Fokker-F32 on its flight test by the department several years ago. These ships were much bigger than anything attempted at that time, and there was a certain amount of "by guess-and-by-gosh" used in their construction. Rumor has it, that the inspector who hopped the ship—Marshall Boggs—told the Fokker people of certain changes he would like to have made before he test hopped it.

The inspector was talked out of the changes against his better judgment, and made the flight with well known results. The ship was a total "wash-out," Marshall Boggs went to the hospital and the papers made a big story out of the results without understanding what caused it. To the author's knowledge, the true facts of this crack-up have never been published before.

It is a well known fact in aviation circles that if three rudders had been used on this ship as Mr. Boggs suggested at the time, instead of the weak one it had, that this crackup would probably have been averted. The writer cannot understand why Boggs flew this crock, knowing what he does about this pilot's ability.

Boggs is a master pilot among master pilots and he has forgotten more about airplanes than the average pilot will ever know. The changes he suggested before the flight had to be made eventually after the flight. The author can see just one reason why Boggs flew this ship. Someone may have insinuated that he was a trifle afraid of the job at hand and that is something

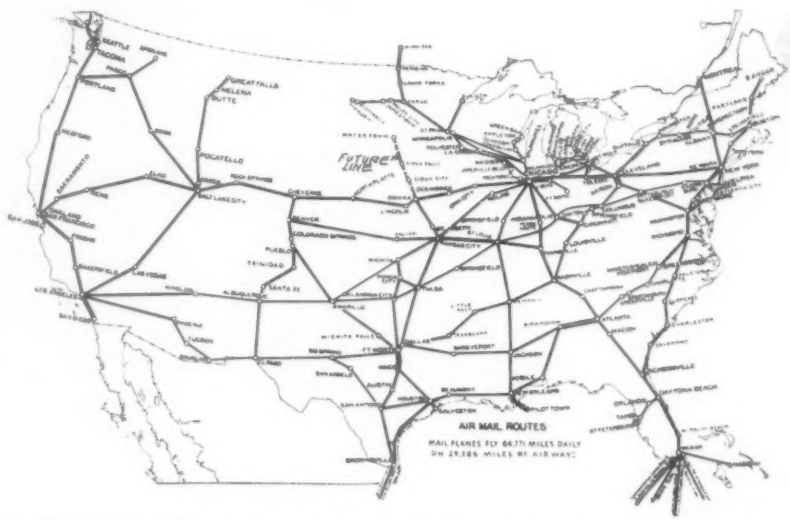
(*Continued on page* 130)

Air Transport Lines of The United States

SCHEDULED air transport lines operating in the United States and with extensions to Canada, the West Indies and Latin America, flew more than 20,000,000 miles and carried 193,651 passengers. They transported 4,589,707 pounds of mail and 1,299,863 pounds of express during the first six months of 1931, according to the results of a survey just completed by the Aeronautics Branch of the Department of Commerce.

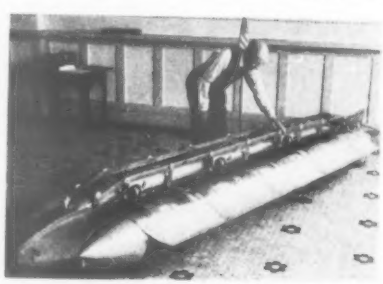
The amount of mail carried represents an increase of more than a half million pounds over the first six months of 1930, and there also was an increase of 54,386 pounds in express shipments over the same period last year. Passenger traffic, however, showed a decrease of 14,706 over the corresponding period in 1930.

The total number of miles flown in scheduled operations, during the first half of 1931, represented an increase of 3,401,702 miles over the same period last year. However, the total number of passenger miles flown (a passenger mile being the equivalent of one passenger flown one mile) showed a decrease, from 52,264,616 in the first half of 1930 to 47,501,901 in the first half of 1931.



A complete map showing all of the air-transport lines in full operation at the present time. A line from Omaha to Watertown will be opened shortly.

A Model of a Giant Dirigible



A scale model of the Freese dirigible.

IT IS to be the world's largest dirigible, according to its inventor, Claude H. Freese. Measuring 910 feet long, full size, Freese claims it is to be big enough to carry 500 persons. He expects the craft to reach a speed of 150 miles an hour against the wind. Under favorable conditions it should attain 200 miles an hour in still air, he says, although it is still in the model stage of development, as shown by the photograph.

Fog Antenna For The Akron

FOGS and cloud banks will not present so great a problem to the Navy's new monster dirigible Akron as they have to dirigibles in the past, thanks to the radio-equipped "feeler" which may be dropped when the Akron is settling over an obscured landing field.

The feeler will signal back to an automatic registering apparatus and indicate the atmospheric conditions in the unseen air levels below. The sending set will be dropped from the Akron on a long cable to feel out the conditions underneath. It informs the navigating officer whether there is clear air under a given cloud bank or whether there is solid fog down to the ground.

Although there will always be a solid connection between the Akron and the sending set, the atmospheric data will still be transmitted by radio, because it is simpler to handle in that way than to make electrical connections and receive the data up the suspending wire. The Akron will have two of the little machines.

XUM

The Flying Radiator Does 408.8 M.P.H.

by WILLIAM J. WHITWORTH

Once more, the Schneider Trophy winner breaks the World's speed record after changes are made in the engine.

WHEN Flight Lieut. Stainforth, in the Super-Marine "Flying-Radiator," breezed along at the average rate of 379.05 m.p.h. in the Schneider Trophy Race, the aviation world sat back and gasped. Then, when his teammate Flight Lieut. Boothman averaged 388.8 m.p.h. on the same day, it seemed as though the climax in high speed flight had been reached.

As subsequent events show, however, these records were not to endure, for on the evening of September 29, Lieut. Stainforth delivered a brand new burst of speed that shoved the official world's speed record up to 408.8 m.p.h. While this was the average over the whole circuit, an early single lap showed a speed of 415.2 m.p.h.—a rate that is unsurpassed by any vehicle that ever moved over land or sea.

It should be understood, however, that the seaplane used in establishing the last record is not exactly the equipment used in the Schneider Trophy Race. It is still the same Super-Marine ship, but the output of its Rolls-Royce engine has been increased by about 450 horsepower.

By making changes in the engine, and by using a composite fuel instead of gasoline, the rated horsepower was increased from the previous 1,900 h.p. to approximately 2,350 h.p., which means a whole lot in the way of performance. The ship has drawn the nickname, "Flying Radiator," from the fact that about all of its available surface is used for radiating heat from its mighty engine. This was explained in the November issue of POPULAR AVIATION.

It is significant that the addition of 450 horsepower only increased the speed by 29.75 m.p.h. above that attained in the Schneider Trophy race. To attain 450 m.p.h., on the same basis, will call for about 850 horsepower in addition to the present 2,350 h.p., and whether all of this engine could be stowed away in the fuselage is more or less a question. Practically all of the surface is now being used for heat radiation, so where are we going to get radiation sufficient for an additional 850 horsepower?

LEFT—Side view of Super-Marine showing its long slender lines. Note the pitch of propeller and length of engine.

+ + +

BELOW — Ready to taxi. Crew directing the ship and giving it initial speed.

As previously predicted by POPULAR AVIATION, we are bumping up against the heat disposal problem at a full 100 m.p.h. below the theoretical ceiling of 500 m.p.h. When we understand that more than 1,000 h.p. in the form of heat must be disposed of through the skin of the ship, we see that additional surface must be accommodated somewhere, and as this additional surface calls for more power to force it through the air, there will come a time when we can proceed no further.

From the fact that a synthetic or composite fuel was used in the record-breaking flight, it is evident that the compression of the engine has been raised very materially. It is said, that the new fuel contained a considerable percentage of alcohol which permits of higher compression without detonations than "straight" gasoline. Such practice is all out of line with practical everyday flying, hence it is doubtful whether such contests actually teach anything of a practical nature or not.

Now, let's sit down and try to visualize just what 408.8 m.p.h. means, for such a velocity is far above any ordinary experience. In the first place, this amounts to 6.81 miles per minute or about seven times faster than the speeds attained by an ordinary automobile. It is nearly four times faster than the speed of the racing cars at the Indianapolis races. It is about twice as fast as a power dive.

Again, if we take one of the fast trains running between Chicago and New York, it will take from 19 to 20 hours to cover the 912 miles. Flying with Lieut. Stainforth, over the same track, the trip would take only two hours and 15 minutes—providing that the Super-Marine could hold up this far. San Francisco is 2,074 miles from Chicago, along the most commonly traveled route, and the time taken by automobile or train is measurable in days. To fly there with Stainforth at his average speed, however, would only take a little over five hours for the trip.

All witnesses to the flight remark the terrific atmospheric disturbance and noise created by the man-made meteor. As explained in an article in POPULAR AVIATION, published several months ago, this noise is inseparable from speeds above 350 m.p.h.—even though the engine exhausts were completely muffled.

At speeds above 350 m.p.h., much of the energy of propulsion is converted into sound waves which also accounts for the sudden rise in the resistance to flight. The air is no longer simply

(*Continued on page* 118)

Starting off and planing over water. Note the fog of spray thrown back by the mighty engine and the swell from the pontoons.

The Edward Heath Memorial Completed

"ED" HEATH, the dean of American lightplane builders, has left an indelible impression upon aeronautics. At the time of his death he held one record that the writer believes more significant of his enthusiasm and energy than any one of his flying records. It was the fact that he had remained continuously engaged in the manufacture of aircraft and aircraft parts for twenty-one years.

In all this time he had designed, built and experimented with practically every type of lightplane and engine. He began his work way back in the early ages of aviation—in 1909 to be exact—and consistently and persistently tried everything—at least once. It is with respect to these achievements that the readers of POPULAR AVIATION have contributed to a fund for the purchase of the bronze memorial tablet shown here and now hanging in the offices of this magazine.

From Mrs. Corrie, Ed's mother and life-long business associate, we have obtained an account of his first flight. This took place on October 10, 1909, at The Antlers Club, Amsterdam, N. Y.—a flight lasting about 40 seconds and about one-half mile in length. He took off from a hillside, and on landing broke the left side of the landing gear.

After making the necessary repairs, he made a second flight on November 2, 1909, starting from the Fonda Fair Grounds. About all of the home-stretch, or one-third mile, was used in taking off, and he just cleared the fence at the end of the track. This was a straight-away flight of sixty-five seconds' duration that also covered about one-half mile. The landing was made in rough ground, where the landing gear was again broken and, in addition, the propeller was badly damaged.

Lack of funds forced Heath to store the plane until the following June, at which time he made a deal with the Sowandoge-Park management for five hundred dollars appearance money. On the strength of this contract, Ed borrowed two hundred dollars from his uncle for repairs and reconstruction. This was the first "big money" that the young flyer had encountered in his career, and he was correspondingly elated with this opportunity.

On July 4, 1910, the rehabilitated plane was tried out, but with disastrous results. The ship would only climb about three feet, and as it could not clear the fence at the end of the field, the total result was a strained fuselage and broken motor mount. However, in addition to the appearance money, Ed had also made about two hundred dollars by selling pictures of the machine, so, to use his own words, "I cleaned up pretty good."

After these crackups, Heath decided to store the plane and to get a job with Curtiss at Hammondsport, N. Y. The fact that he had raced Glenn Curtiss on a motorcycle got him a job at the Curtiss plant. But this was not the job he wanted, for he was placed in the motorcycle department as an assembler instead of in the coveted airplane division. Here he fell in with Walter Eales, who was building a Curtiss type ship but who had no engine. A deal was made with Charles Dirckmann for one of his automobile engines, and thus equipped with power, the two partners were ready for flight on the evening of September 5, 1910.

It was agreed that Ed was to be the first one to try out the ship, and after running about 300 feet the ship took-off and climbed very rapidly to about 50 feet. The flight path was rather unsteady, but by a dint of work Ed succeeded in flying about two miles, and on landing burst a tire. The duration about three minutes and 30 seconds.

INSCRIPTION—"To Honor the Memory of Edward Bayard Heath, Pioneer, Aviator and Engineer, 1888-1931. By the Readers of Popular Aviation."

It was Eales' turn on the next day, and as he had a considerable amount of verbal instruction from Curtiss, he made a very steady flight of about the same duration and length as Heath had made on the day before. On the following week several straight flights were made, and during one flight the first 180 degree turn was made by Eales. Heath later sold out his interest in this plane upon receiving a telegram from his uncle that a deal had been closed for his appearance at Gloversville, N. Y., and the original Heath monoplane was then put into shape.

From this time on Ed Heath was engaged almost continuously in the construction of aircraft, most of his later life being spent in Chicago. Because of the variety of jobs handled in his shop, Heath's plant was a veritable museum. It was at this time that aeronautical styles and fashions turned face-about over night, so rapid was the development, and this accounts largely for the vast amount of experimental work and the great variety of models seen about the workshop.

Naval Officials Study Parachutes

THE Naval Bureau of Aeronautics recently completed plans for a new type of parachute to be worn only when needed, but which may be snapped into position by only a single movement of the hand. They report that there is a growing need for aerial "life preservers" for passengers, machine gunners and others who are handicapped by the continuous wearing of the chutes while in flight.

Naval officials are also studying a new type of instantaneous release, permitting the jumper to discard his chute instantly upon landing in water or in case of dropping on land where the high winds sometimes drag the jumper and seriously injure him before the parachute collapses.

The bureau announces that it is concentrating the greater part of its development upon the "sail" or silk canopy of the chute, both in material and method of construction. Better containers for the canopy are being tried, which will provide more compact stowage and improved protection of the silk. And, again, an adjustable and more comfortable harness for the descent.

Although silk is generally recognized as the most suitable sail material, the Bureau is also attempting to develop other fabrics, possessing silk's desirable qualities in low weight, high strength and compactness. This is extremely necessary in case the country would suddenly be cut off from its silk supply.

The new type of chute requires the wearing of the harness only. The chute is stored close at hand like life preservers at sea. In case of sudden descent, the only motion required by the wearer is to snap the canopy to the harness. It then functions in the same manner as a regular parachute. The Bureau reports that the lives of over fifty naval pilots have been saved by the use of chutes.

Invents Self-Stabilizing Wings

WHAT he calls "corrective stabilization" wings have been invented by an amateur aviator, Wilbur Cornelius, 32, who makes his living as a salesman.

Cornelius has been tinkering with airplane wings since he made his first flight at the age of 16, believing that safety in flying depends entirely on them. He finally has succeeded in making them a single unit, working in coordination with the tail surfaces.

The wings, which have been attached to a plane and tested satisfactorily, are pivoted on struts, working in conjunction with the tail surfaces on ball bearing axles. The wings are perfectly balanced. Their entire length tilts to the pilot's stick. There are no ailerons. Cornelius says he can set his plane down in 175 feet, and at the limit of climbing power it will nose over into level flight.

XUM

An Airship Goes Out for a Walk

by WALTER E. BURTON

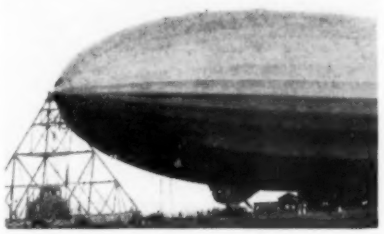
How and why the U. S. S. Akron is given its daily dozen and just how they undock this Colossus of the air.

THE U. S. S. AKRON, newest Navy airship, almost always will take a walk before venturing into the air, particularly if she has been reposing for some time in her dock. This walking-out is officially and technically known as "undocking," and is necessary in order to get the ship out into the open before it takes off.

Undocking is as interesting and involved as the flight itself. At a predetermined hour, flight and ground crews assemble in the airship dock. Members of the crew go to their various landing stations in the ship, while the captain and executive officer, the latter also acting as mooring or ground officer, together with their aides, remain on the ground.

All is now in readiness for the starting of the ship's little land journey. The mooring officer commands, "Standby to walk ship out." Following this comes the terse order, "Walk ship out." At the same instant, the mobile mooring mast, side handling cars and groups of men on the handling-line spiders, begin moving the ship in the previously designated direction—either forward or astern.

From 10 to 24 men are on each of the handling lines attached to the after part of the ship on both the port and starboard sides. These groups supplement the side handling cars (ten-ton masses of steel), the windlass and the motors on wheels running over



The mobile mooring-mast guiding the Akron out of dock.

railway tracks extending through the dock. These cars are started on their tracks by a group of men on the spider attached to a line fixed on one end of each car.

After the ship has gained momentum, the towing bridles attached to the ship haul the cars along their tracks, the men standing by to act in case a car should stick. Thus, each car, equaling in weight more than 50 men, acts as a sort of mobile anchor that smooths out the movement of the ship. The car does not move under its own power but, once started, is dragged by the ship.

The mobile mooring mast, a huge tetrahedron of steel girders on a trio of caterpillar tractor treads, is holding the ship by the nose—guiding it out of the dock.

If everything is going smoothly, the mooring officer permits the ship to proceed out into the field until it has cleared the dock enough to swing about in the wind like a giant vane. Then he cautions, "Slowly," and next commands, "Halt," or "Hold."

IF YOU were a spectator, you might wonder how everyone, from the men on the mooring mast to those in the after control cabin in the lower tail fin, can hear the orders. The mooring officer uses a megaphone, enabling him to reach all officers and men within range of his amplified voice. His commands are further relayed by an officer stationed just forward or aft of amidships, to those beyond range of the megaphone.

The ship's telephone system carries the words from one control car to the other, and also to the men stationed on the mooring mast. It is important that all commands reach all points at the same time.

The ship has now ceased its slow movement out of the dock. The mooring officer commands, "Trip the mechanical landing gear." This applies, for the moment, only to the steel handling car lines on the leeward side. They are released. Those on the windward side are then slackened so that the ship swings around into the wind—then they are dropped.

Next comes the command, "Remove taxi-wheel and attach bumper-bag aft." There is a scurrying while the wheel under the tail fin is removed and a bumper-bag, containing an air cushion reinforced by a series of rattan ribs, is attached in its place.

"Standby to weigh off," is the next command. At this point the captain probably will go aboard. Then the mooring officer shouts, "Weigh-off aft." Men who have been holding to the hand rails on the after control car release their holds, and the "spider men" permit their handling lines to become slack. The tail dragline also is slackened. The manner in which the ship floats in the air will determine whether ballast should be added or removed to make the after-part buoyant to the proper degree. Then, the tail dragline and side-handling lines are tightened.

Following this command comes the order, "Standby to weigh-off forward," and then, "Weigh-off forward." There is less action in this process than in the after weigh-off because the nose of the ship, being attached to the mooring mast, does not move perceptibly. The degree of buoyancy is indicated by electrical instruments in the main control car which measure the pressure or tension on the mooring cone directly.

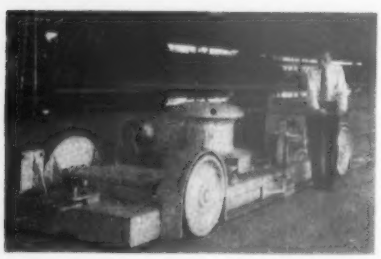
The Elevator Man, who by turning the wheel, can raise or lower the nose of the ship. This This controls altitude.

The Engineer Officer sending orders by telegraph to the eight engine rooms of the Akron.

AFTER weigh-offs have been completed, the mooring officer goes aboard, together with his assistants. The airship's little walk is practically over. The captain gives the command, "Drop the tail drag." This drag resembles a pair of railroad car wheels with a flattened axle along which weights can be placed. It is attached to the ship, a short distance forward of the tail fin, by a steel cable and rolls along the ground when the ship is walked out of or into the dock.

When the ship "vanes" in the wind about the mooring mast, the tail drag moves about in a circular path. Following release of the drag, the handling spiders at all points are released, leaving the ship held to earth only by the mooring mast and the men at the control-car hand rails.

"Standby to up ship," the captain sings out. Everyone becomes alert—for this is a critical moment. "Up-ship," he commands, and the mooring mast and men at the control cars release their hold. Those men, who had been clinging to the main control-car hand rails, use long Y-shaped poles or



One of the side-handling cars of the Akron.

"crutches." The padded prongs of the crutches fit about the rails and push the forward part of the airship into the air.

If a "free-balloon take-off" is in order, the ship rises to a height of about 200 feet before its engines are brought into action. With its swiveling propellers, something new in airship equipment, the Akron can push itself into the air if necessary. It normally uses only four of its eight engines for this purpose.

The captain next orders the "ahead" engines started, ballast dropped forward (amidships or aft if the craft needs trimming) and whatever other changes he deems necessary. His commands are transmitted by the officer of the deck to other officers, and by them to members of the crew. Engine orders are given over the engineroom telegraph system, operated from the control car.

THE captain next tells the officer of the deck the altitude at which the ship is to fly, and this order is transmitted to the elevator men—those who control horizontal rudders. Next, the deck officer transmits the course selected to the navigator and executive officer.

The ship is under way at last, after

(*Continued on page* 115)

No Aces Required in Next War

THERE will be no aces in the next war, according to Maj. Gen. James E. Fechet, chief of the Army Air Corps.

Formation flying, Gen. Fechet holds, will be the rule. This does away with flying heroes and death-defying aces with long records of bringing opposing fliers to earth by well-aimed solo machine gun fire.

The Army Air Corps, recently, was criticized for emphasizing formation flying because of the accidents it has caused, and his abservations were made in defense of the practice.

Air forces in the next war will maneuver and fight just as infantry in the past has fought as units on the ground, Gen. Fechet declares. Formation flying is something army aviators must learn. If a few men are killed in the process it is regretable, but from the military standpoint it will be necessary if we are to have an air force as effective as other nations.

The public has an exaggerated idea of the hazards of formation flying, says Gen. Fechet. Only one-tenth of one per cent of the accidents are caused by it.

"The day of knight errantry in the air is past," asserts Gen. Fechet. "Should there be another war, air forces will fight in divisions of 200 or more planes of various types, all operating under unified command. The division's objective will be to win control over a certain sector of air in the same way the infantry does over land.

"Individual planes will not be able to attack such divisions and live, since the latter will be so organized that each wave will be protected by a succeeding wave flying behind and above. The rear is brought up by two-seaters equipped with swivel guns capable of beating off any threat from that direction.

"Adoption of such tactics, means that close formation will be necessary, both for maximum offensive power and for safety of individual pilots. Concentration of fire power will be everything."

Engine Self-Starters Tested

A NEW starter for military airplane engines, of the cartridge type, was recently tested at Wright Field, Dayton, O.

This starter is installed on the engine in the same location as the standard inertia starter. It is approximately ten and one-half inches long, consisting of a cylinder in which a piston is pushed forward by the expansion of gas from a slow burning powder. It is set off electrically from a ten-gauge shell. The shaft on which the starter jaw is attached moves forward and turns the engine crankshaft.

The starter weighs nineteen pounds; the breech and piping four pounds. The cartridges run twenty-two to the pound. A total weight of twenty-five pounds thus would be equivalent to forty-four starts of the engine.

She Studies Navigation

Miss Burns receiving instructions in astronomy.

Juanita Burns, local aviatrix, announced that she will leave for Japan by steamer, from where she will attempt a solo flight from Tokio to Seattle. The flight will be made in an effort to win $50,000 in prizes which have been offered to the first pilot to cross the Pacific ocean without a stop.

She expects to make the trip in 30 hours with a locally built plane which will be shipped to and assembled in Japan. She is now taking lessons in navigation from Capt. T. Cameron Wilkinson, a former Royal air force pilot.

Sky Writers Hard at Work

Three sky-writers zooming upwards, leaving three trails of colored smoke.

PHOTO shows three sky writing acrobats pirouetting in the skies. Colored smoke is released by the fliers rehearsing their stunts for the Royal Air Show at Hendon. This shows marvelous control and an exceptional knowledge of aerobatics.

XUM

Some Pilots I Have Met

by FRED KRUG

THERE are pilots and pilots, many of whom are real characters, but every airport has at least one sample of the two following varieties on full display. Fred Krug, one of our junior flyers, gives us a little sketch of these two airport pests with a full understanding and a considerable sense of humor. Let's go.

THE GROUND PILOT

He's all dressed up like an advertisement for flying gigolos. His white whipcord pants, smooth black leather jacket, black helmet and Smith's guaranteed shatterproof goggles — price $1.50. All this helps to make him a hero in the eyes of the poor ground folks. He struts around, telling of this flying business—something like this:

"Now, young man, take it from me. I have flown every plane made. I've about 14,000 hours in the air without a single accident. Over mountains, valleys and streams have I flown them. Once, while flying a Lockheed, my OX-5 motor gave out, but I glided three miles to an airport and landed perfectly.

"Yes, my boy, I am a flyer, but I am not conceited about it. No, in fact anyone can fly. By that, I mean, everyone can fly, but not all can be in the same class of men like Lindbergh, Captain Hawks or myself. We were born with the spirit to fly. That's it, my boy —spirit. I can assure you that I think you will make a good flyer. Yes, indeed son, and I will give you my autograph. Well, so long, I have to go up now."

THE PRACTICAL JOKER

"Hello, mister, going up? Well, I wish you luck, but believe me, this is an awful day for flying. You'll need all the luck you can collect with 100 horseshoes and 50 rabbits' feet. I think the field manager should have a sign painted, and put out on the field, telling you poor people what you are up against.

"Is there any danger? Well, I should say so. Do you know that when a motor conks-out that the ship will crash? Sometimes a wing falls off and sometimes the wheels fall off—sure death for everybody in the ship.

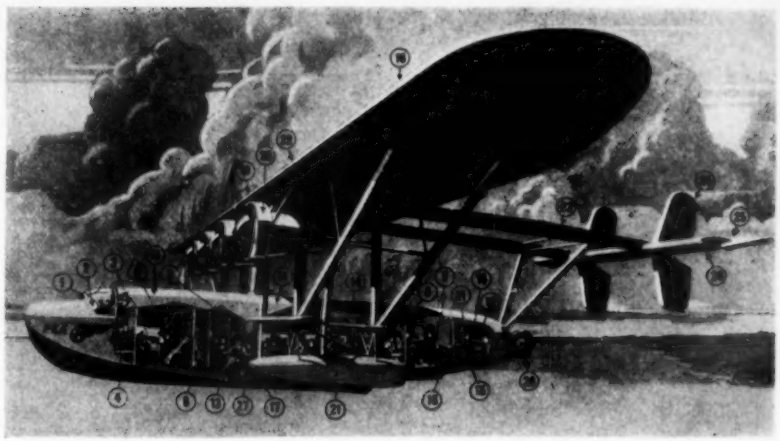
"Why, mister, you haven't got a chance in the world up there. You don't even have a parachute on. I'm sure sorry for you. Well, goodbye old boy, I hope you have a nice ride."

He shoots this into the pale faced aviation fan, the fan gulps once or twice and then hurries from the field as though he had committed a crime. Then the joker walks around to find some more green birds, so he can have some more fun.

Flotation Gear Devised

NAVY engineers have just completed the invention of a device to aid fliers who are forced down on water. It is a valve operated by water pressure, which automatically inflates the flotation gear when a landplane is forced down at sea.

Details of The Giant Sikorsky



A sectional view of the Sikorsky "American Clipper," showing the passenger accommodations and many of the technical details. (1) Cockpit for the accommodation of four members of the crew. (2) Master controls handled by pilot, the co-pilot operating the auxiliary controls. (3) Radio receiver and transmitter with a range of 3,700 miles. (5) Interior walls, inlaid with mahogany. (6) Sound insulation to cut off noise and vibration of engines. This section is also used as an extra mail and express compartment. (7) Indirect lighting system. (8) Full size lavatories with hot and cold running water. (9) Smoking room. (10) Steward's buffet. (11) Electric stove. (12) Electric refrigerator. (13) Heating system. (14) Emergency exits. (15) Entrance. (16) Lifeboats which can be inflated from compressed air tubes in a few seconds. (17) Exterior surfaces are metal with the exception of fabric wing covering, outriggers and tail-group. (18) The main wing. (19) Four "Super-Hornet Engines, totalling 2300 H. P. (20) Engine cowling. (21) Each pontoon carries nearly a ton of gasoline. (22) Wing tanks carry approximately two tons more of gasoline.

THE world's largest amphibion, the Sikorsky S-40 has completed satisfactory fight tests.

Powered with four 575 h. p. Hornet motors, this plane, which has a maximum gross weight of seventeen tons, left the water in nineteen seconds and maintained a cruising speed of 110 miles an hour.

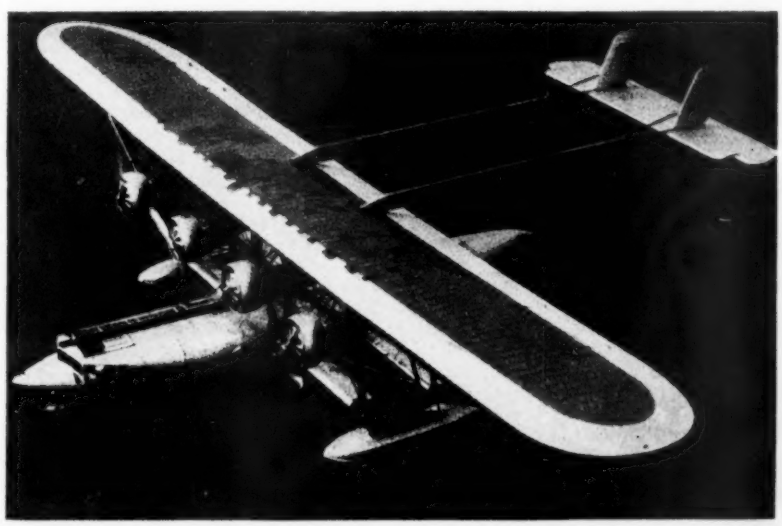
Landing speed was under 60 miles an hour. With any three of the four engines cruising speed was 95 to 100 miles an hour.

The big Sikorsky amphibion is a high-winged monoplane with the Hornet motors installed tractor type in the nacelles supported from the wing. Wing span is 114 feet and the plane 75 feet in length. It can cruise 1,000 miles without refueling.

All interior draperies, rugs, curtains and furnishings are fireproofed. The plane has an ice box, electric stove, steward's pantry and room for extra storage space.

There are electric fixtures in each compartment, a call system for the steward, and individual ventilation units. Emergency food and drinking water make this plane independent at sea for an indefinite length of time.

Six life-saving rafts, with emergency rations and water, are conveniently located at each exit. The plane will be put into service by Pan-American Airways.



The Mammoth Sikorsky Ship in its trial flight over the Atlantic. It will be christened the "American Clipper" in honor of the early sailing vessels that at one time made America supreme in marine shipping.

Air-Propeller Boat Skims Over Danube

The engine and pusher propeller are located at the rear to obtain maximum traction. The cabin forms part of the hull and is completely enclosed.

THE new type propeller boat, "The Dolphin," attained a speed of fifty miles an hour at its trials on the Danube River. Its new features mark an innovation in marine construction while the fact that it draws but little water enables it to skim swiftly over the surface of the river. Its development is hailed in Europe as a solution of the problem of navigating rivers having swift or treacherous currents.

The hull planes over the water at high speed so that the depth of immersion is still further decreased when compared to the immersion standing still. While this type of propeller driven hydroplane may be very effective in fighting stiff currents, as claimed by the inventors, yet its effectiveness will be considerably reduced when running against a high wind.

Twentieth Anniversary of Air Mail

ALTHOUGH the twentieth anniversary of the first airplane air mail flight in America was celebrated at Roosevelt Field, N. Y., by the Post Office Department and American Airways, it was not actually the twentieth flight anniversary but the 102nd.

In September, 1829, Paul Dumont, a New York merchant, announced that he would make a balloon flight with mail from the Battery. He did not fix a destination, but carried letters addressed to Connecticut, New Jersey and up-state New York. He also carried a letter to King Charles X of France, in case he was blown across the sea.

On the appointed day, with flourishes and fanfare, Mr. Dumont brought his balloon to the seawall and loaded it with sixty pounds of mail. New York newspapers provided him with six carrier pigeons so that he could report his progress.

The balloon rose fifty feet, then faltered and started to fall. Mr. Dumont threw out his ballast and finally jettisoned the mail sack, dropping it into the bay. Relieved of its load, the balloon sailed away amid cheers and landed near Perth Amboy, N. J. Fishermen with boathooks rescued the mail, which takes seniority over the first airplane airmail carried by Earle Ovington in September, 1911, by eighty-two years.

Mr. Dumont, with his balloon on an ox-cart, returned three days later and received the first welcome-home reception that New York City had ever accorded an air-mail pilot. Newspapers of the day carried columns about it.

Twenty years ago, Earle Ovington, the world's first licensed airplane mail pilot, drove the first air mail plane five miles from Garden City, Long Island, to Mineola, and dropped a bag containing 640 letters and 1280 post cards. His plane was a little Bleriot monoplane powered with a 70 h.p. Indian rotary engine. This was also the first air mail flight with a fixed destination in view.

In September, 1931, the great growth of the United States air mail during two decades was fittingly celebrated at Garden City. In the nine days of the Nassau Aero Meet, of which Ovington's epochmaking flight was a spectacular part, 37,470 pieces of mail were carried. Today there are 43,000 miles of air mail lines in the United States. In the twelve months, ended June 30 last, air mail pilots carried 4,290 tons of mail and flew 21,380,517 miles with an average of one million pieces of mail daily.

The original Indian engine used by Ovington is now displayed in a glass case in the Aircraft Building of the Smithsonian Institution in Washington, where it is given a place of honor with other airplane motors which have made

(*Continued on page* 117)

Oxygen At High Altitudes

IN FLYING five miles above the earth, the proper control of the oxygen supply is imperative. The 95th Pursuit Squadron, which is stationed at San Diego and which holds the international record for high-altitude formation flying, use oxygen sparingly during the early part of flights above 15,000 feet. No oxygen is used up to that point and little is taken until the 20,000-foot level is passed.

On climbing higher, the army pilots breathe oxygen through a tube held between the teeth, regulating the supply by a device beside the seat. Large quantities of oxygen are taken above 25,000 feet. The thermometer drops so low around the 30,000-foot level that oils and grease freeze. The ceiling of the late-type army fighting planes is now twice as high as wartime planes, and they can climb nearly two miles higher than the pursuit planes of three years ago.

Minnesota's Only Woman Glider Pilot

MRS. CLOVIE TIPPIE, St. Paul, is Minnesota's only woman glider.

Three high school boys, who went without lunches last year to save money for a glider, taught her how to manipulate the ship. They had a broken wing and needed money for repairs, whereupon she offered to pay their expenses if they would teach her how to fly the glider.

The boys found an abandoned rye field near the Twin Cities, and taught Mrs. Tippie, who has now applied for her license. The boys who built the glider and taught her the art are Stan Gowan, Tom Dalldorf and Louis Kiern. They obtained their knowledge of gliders through an aviation course in a St. Paul high school and also through an aviation club that they formed as an extra curricular activity.

Mrs. Tippie looks rather pleased with the outlook.

XUM

Glider Notes for the Novice

by MARTIN SCHEMPP AND JACK HERRICK

Final practical instructions on the handling of gliders by these nationally famous glider pilots.

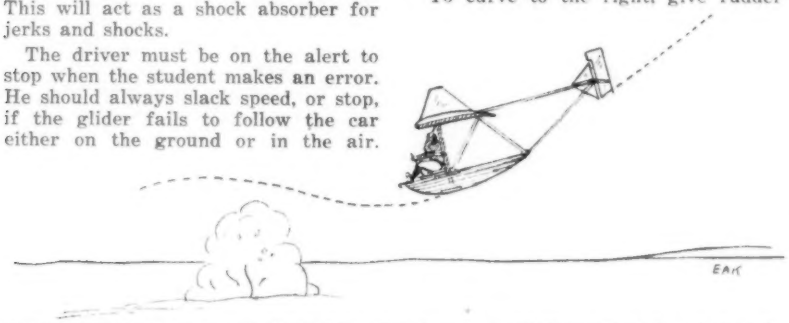
NOW we have reached the stage where the pilot is able to take off, fly straight and level, and can make a clean landing. From now on the student, by means of auto-towing or shock cord flights, irons out his flaws and learns to make properly banked turns.

There are a few details to remember, if auto-towing is to be used. Use a light flexible, steel aircraft cable, 100 feet long and ⅛ inch in diameter as a tow line. Increase the length of this cable up to 500 feet as the pilot progresses and desires to go higher. Instead of this expensive cable, ¼ inch manila rope can be used. The rope has an advantage over the steel cable in that some of the shock is absorbed. Yet, for the extra long lengths of tow line, the steel cable is better for it offers less air resistance.

It is better that this tow line be light enough so that it will break rather than pull the ship apart. Some people add a piece of shock cord or spring to the tow line on the end near the car. This will act as a shock absorber for jerks and shocks.

The driver must be on the alert to stop when the student makes an error. He should always slack speed, or stop, if the glider fails to follow the car either on the ground or in the air.

A secondary glider just after the take-off. The ground crew is still standing in the foreground.



Correct method of clearing an obstruction. Dive to gain speed then pull back and clear it.

The driver should start slowly, change gears cleanly and gain speed gradually.

It is advisable to follow these rules: (1) Never allow excessive kiting or climbing. (2) Never tow a glider faster than twice its normal landing speed. (3) Take frequent rest periods and talk over the previous flights. (4) Keep ropes and cables off runways where they have a chance of hooking on to the tail skid of a power ship. (5) Never allow cable angles of more than 70 degrees to the ground and only then with some provisions for taking the shock. (6) Nose the glider well down before releasing the cable. (7) Don't try to make turns at low altitudes. (8) Don't attempt to show off. And (9) never get over-confident.

WHETHER getting into the air by auto or shock-cord power, the making of turns is the same. Practice very gentle curving to the right and left at first. Bear in mind that the rudder and aileron action slows up the forward speed of the glider. Therefore, it is necessary that the glider should be nosed down quite a bit to pick up speed before the turn is started. Always remember in curving, to move the rudder and aileron controls on the same side together.

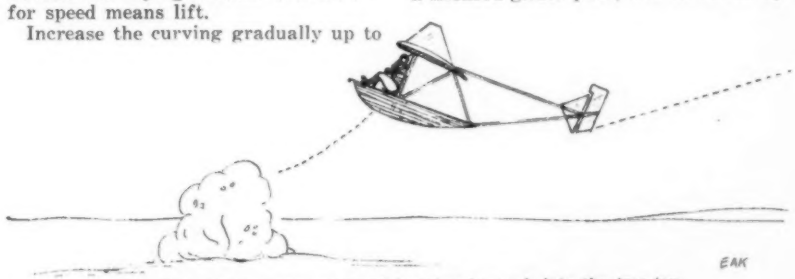
To curve to the right, give rudder with the right foot and move the stick a bit to the right. To get out of the curve, give opposite rudder and aileron. As soon as the glider is brought back to the normal position, put rudder bar and stick in neutral. Be warned against pulling back the stick in curving as it is often unintentionally done. Hammer this into everybody's mind: SPEED in flying means SAFETY—for speed means lift.

Increase the curving gradually up to 90 degree turns, and practice equally on both sides. Sharper curves demand more banking. Yet, never bank more than 45 degrees, for then your controls would act in a different way. You may be thrown into a side slipping position by a wind gust or by wrong controlling. Now, you use the ailerons to straighten out, but perhaps in vain, for you don't have enough forward motion.

In this case instead of landing on the wing and smashing the glider, you can nose down and apply rudder on the side of the dropped wing, thereby changing the sideslip into a curve. Yet, if ever avoidable, do not land with a tail or side wind for it will be hard on the runner.

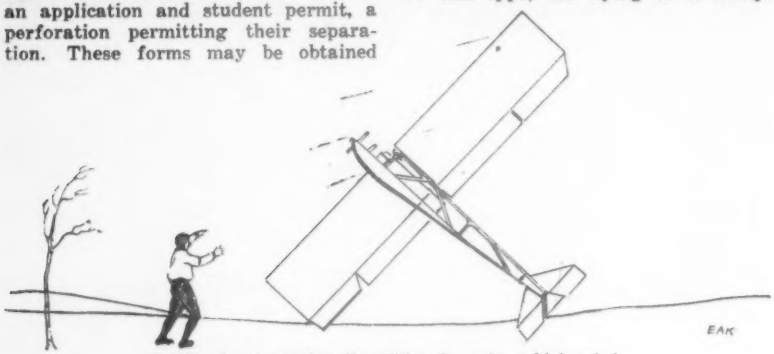
AND so keep on practicing with your glider and build up your skill and knowledge. Learn to make 360 degree turns, and how to use such instruments as the air speed indicator, turn-and-bank indicator and the altimeter. When the instructor says you are good enough, make your license flights. We will repeat the information for the benefit of those still in doubt.

Three types of glider-pilot licenses are provided: Student, Non-commercial and Commercial. Glider-student permits, authorizing the holder to receive instruction and to solo licensed gliders while under the jurisdiction of a licensed glider pilot, will be issued by



This pilot pulled up too soon and is going to crash into the tree-top.

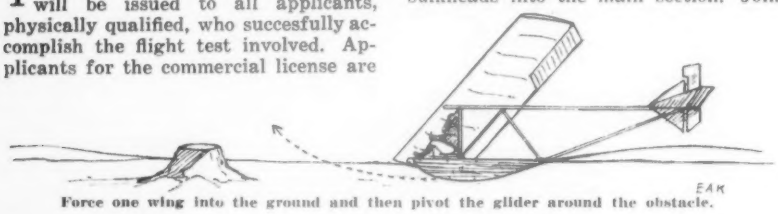
ıe Department of Commerce inspector and department divisional offices upon application. No physical or written examination will be required. A form has been drafted which is both an application and student permit, a perforation permitting their separation. These forms may be obtained from any Department of Commerce inspector or divisional office.



Result of not pegging the glider down in a high wind.

The non-commercial glider license will serve the group that is desirous of operating gliders only for sport and pleasure. This license parallels, to a degree, the private airplane pilot license. The only examination required for this license will be a flight test including moderate banks in either direction. Applications for non-commercial glider licenses may be obtainable from department inspectors or divisional offices.

THE commercial glider pilot license will be issued to all applicants, physically qualified, who succesfully accomplish the flight test involved. Applicants for the commercial license are required to pass a physical examination, the same as now required for the private airplane pilot license. There is no written examination. The flight test, in addition to normal take offs and landings, include a series of general and moderate banks, 360 degree turns and precision landings. Applications may be obtained from department inspectors or divisional offices.



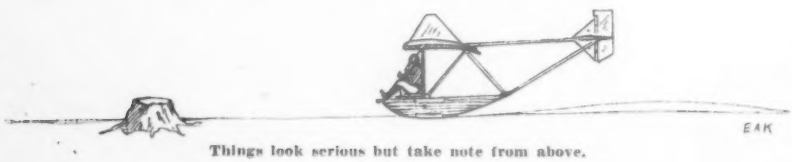
Force one wing into the ground and then pivot the glider around the obstacle.

If a primary has been used so far, next fly a secondary training glider if possible. This type of glider differs from the primary type in having a streamlined closed fuselage and instead of wire bracing, has streamlined struts. The head resistance is therefore much less and the flying qualities much better. The gliding ratio will be about 14 to 1. You will feel in your first glide, the greater sensitiveness of the controls and the ease in curving.

Be careful at first until you are used to this type, for flying in a cockpit doesn't give quite as good a view when landing as the open type. This secondary enables one to make extended glides of several minutes and to get more practice in curving. We pick out different hills raising up to 500 feet and suited for gliding, so as to acquire valuable experience in new territory. Always be sure that there is sufficient space around for a safe landing.

HOWEVER, if the finances of the glider organization are limited, we can improve the old PTG. With ⅛ inch plywood, and ¼x¼ inch spruce, build bulkheads into the main section. Join them with longerons so that we have a streamlined frame, starting at the nose of the glider, surrounding the pilot and tapering to a point at the rear of the runner. Cover with fabric and dope. We can also go so far as to cut off the cabane and substitute strong streamlined struts for the wire bracing. This inexpensive operation will increase the gliding ratio 3 to 4 points more, and will enable the pilot to make longer flights.

So keep on gliding, learning new facts, spreading your knowledge, progressing cautiously, and soon you will find out how to take advantage of the upwind to flatten your glide, and finally will pass from simple gliding into soaring flight.



Things look serious but take note from above.

French Glider Pilot Warns Comrades

ONE of our French readers, Antoine G. Menier of Paris, writes us an interesting and important letter dealing with safety in gliding flight. We are always glad to receive letters of this sort and am sure that our readers will be quite interested in French glider practice as set forth in Mr. Menier's letter.

"Reading POPULAR AVIATION regularly, I notice an article on page 25 of the May issue about an accident with a Rhon Ranger glider.

"Here is a personal and recent experience which may be of much interest to all glider fliers of America. Let's call it:

Be Careful When Buckling Your Belt

"As a member of a Parisian glider club, I was flying one afternoon in an EOLE type glider (very similar to the Rhon Ranger type that American people use). It is the best French training glider on the market. After several good flights, I was launched for another and reached an altitude of about 30 feet.

"Then, as I wanted to move the ailerons, I felt that the stick was quite "hard," and it was impossible to move it any way. By this time the glider began stalling and falling down on the left wing. In a last and big effort I obtained a slight movement of the ailerons and the glider crashed in a flat position without breaking the wings.

"The rudder bar crashed, but happily my legs were not hurt. The slide was broken too. My comrades and I were very puzzled about what could have happened, when we finally discovered that my belt had been improperly tied and was pressing against one of the vertical cables that control the ailerons.

"This had made the cable jump out of the pulley at my first lateral movement, and the stick had been blocked in a sidewise position. Of course, we will now be very careful to fasten the belt tight and in the proper way. I'll be very happy if the knowledge of this accident in France may prevent similar crashes in American comrades' clubs."

Flying Nursery Built For Air-Minded Babies

EDMUND T. Price has fitted his all-metal transport plane as a flying nursery, and Price's three children recently completed a transcontinental trip in the re-vamped plane. Mitzi, 9, Charles, 7, and Joan, 3, have early learned that the comforts and pleasures of home are not necessarily lost when one goes air traveling.

Several of the passenger seats of the huge plane have been removed and an up-to-date nursery is arranged in the plane's cabin. Clay modeling outfits, puzzles, crayons and other toys are on board, as well as little Joan's crib.

XUM

Yes, We Like Gliders, Gliding And Repairs

THIS yarn may be all gummed up, but it's my story—and I'll stick to it. In the fall of 1929, Roy Taylor and I decided to build a glider. Why this idea should have entered our heads we can only surmise. Maybe the heat had something to do with it.

We started to build from plans—and Oh, those plans! They called for baby buggy wheels and wing warp for lateral control, not to mention the umbrella rib tail surfaces.

We had not finished the wing before we realized our mistake. We eliminated the baby carriage wheels, substituting the standard skid and did away with the umbrella rib idea, but the wing warping remained.

The MTG-1, McNash-Taylor Glider-1,

Training glider ready to go.

as we affectionately called it, was finally more or less completed. We then towed it backwards on a dolly, with the wings lashed to the fuselage, out to Harry Hart's farm, about 18 miles over roads that were not meant to have gliders towed over them.

The trip out was highly successful. That is, up to the time when the whole apparatus overturned, crushing the leading edges of the wing. We propped the leading edges up temporarily, to form something that at least resembled an airfoil, and then carefully assembled the crate.

By the flip of a coin—yes, we actu-

Hard at work after a crackup.

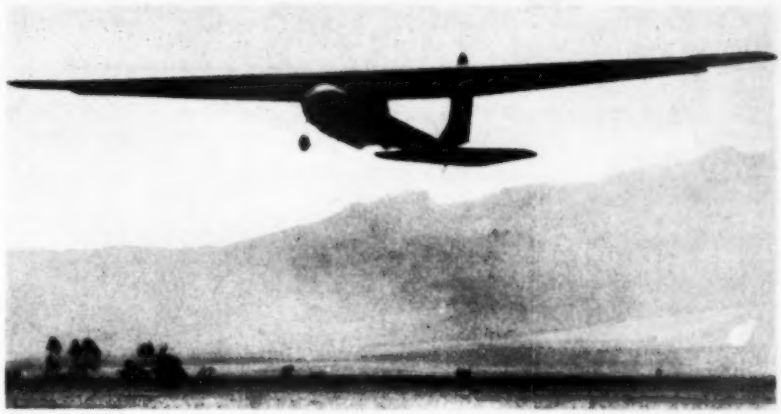
ally had one left after building the thing—it was decided that I would be the first to fly.

After listening carefully to the well meant advice of the farmers, who had come to see the test flight, I strapped myself into the collection of boxwood and bailing wire.

Suddenly I was all alone, as the crowd cleared away, and the ground crew took its place. I felt about as secure as the Eighteenth Amendment. After several unsuccessful skids, I managed to get our brain child off the field, which, by the way, also furnished the farm's horses with their three

(*Continued on page* 115)

Crain Breaks Glider Endurance Record



Lieut. Crain's glider taken during its record breaking flight. One of the few photos taken of this event.

TAKING off from a pineapple field near Kaneohe Bay at 2:35 p. m., July 25th, 2nd Lieut. John C. Crain, Air Corps Reserve, established an unofficial world's glider record for sustained flight. He landed at 7:12 a. m., July 26th, after 16 hours and 38 minutes in the air. The sailplane was constructed and designed by 2nd Lieut. William Cocke of Wheeler Field.

Lieut. Crain did not remain aloft longer because he was tired out. During the period from 3:30 p. m. Saturday, and 5:00 a. m. Sunday, he flew through several rain storms, which added much to his exhausted condition and discomfort. He maintained an average altitude of 3,000 feet during the entire flight.

Searchlights from the Coast Artillery Corps were used to illuminate the cliffs of the Nuuanu Pali to prevent an accident to pilot or glider when changing his course. Without these lights, the flight under the existing weather conditions would have been impossible. Chocolate bars, a canteen of cold coffee and a canteen of water were the only provisions carried by Lieut. Crain during the flight.

Spring Skids Absorb Landing Shocks

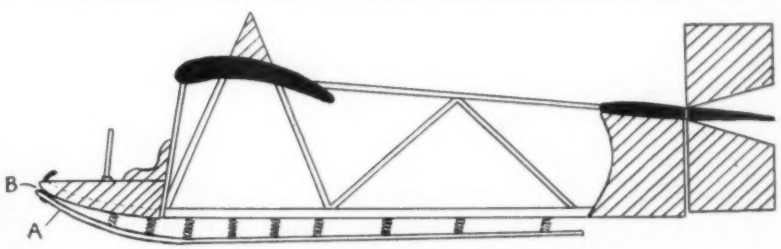


Fig. 1. Showing complete assembly of shock absorber.

ALL airplanes, no matter how small or simple, have some means of absorbing landing shocks. Strange to say, little has been done about providing shock absorbers on gliders, although you often wish that there was something there to take the bump away from your spinal column.

While it is difficult to devise a shock-absorber for a primary trainer skid, yet this is not impossible, as the accompanying drawings show. This consists of a thin flexible sub-skid (a) attached to the main skid by automobile valve springs. The assembly is shown by Fig. 1.

The valve springs are spaced evenly along the skid as shown, and will make the ship much more comfortable when landing. There is enough "give" in the false skid to cause an appreciable movement.

Between the springs, and acting as guides for the springs, are the bolts shown in the detail view, Fig. 2. These

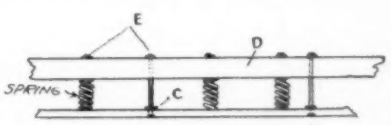


Fig. 2. Detail of springs and bolts.

bolts are fastened to the under skid and are free in the main skid.

As the length of the skid increases when it is loaded, it will be necessary to allow the false skid to slide at the nose (B).

JUNIOR ACTIVITIES
Edited by Paul W. Clough

JACK CHAPMAN, 11 years old, of Riverhead, L. I., made two solo hops September 29, and another on September 30.

Jack had eight hours of instruction before he soloed. His instructor was William Turso, who works with Jack's father. He flew a "Le-Blond 60" Arrow-Sport which is owned by his father.

Jack had his first ride three years ago in his dad's old Standard, at the age of eight. He will be twelve in January and is now in the sixth grade in school. Jack did his flying at the Suffolk Airport, Riverhead, L. I.

Jack, being too young to get his student's permit, had to fly an unlicensed ship. You must be at least sixteen years old to receive a student's permit or a private license. On October 1, 1931, a law went into effect that no unlicensed ship can fly in New York State, and in order to fly a licensed ship you must have a student's permit or a license. Jack cannot do any more flying until he is sixteen, so he must wait about five years.

Jack is the youngest to solo. Joseph Sheneen of Suffern, N. Y., soloed last spring when he was twelve years old.

* * *

We recently heard from Edgar Paschal, 17, of Frisco, Tex., who builds model airplanes and expects to learn to fly soon. Well, we all wish you success in the aviation game.

Vernon D. Shaffer, 17, of Pottstown, Pa., has been doing quite a bit of flying. Vernon soloed last August when he was 16 years old. He soloed an OX-5 Eaglerock after eight hours of instruction. Vernon is saving up his money to buy a ship. He is also an Eagle Scout in a local Boy Scout troup.

* * *

Eddie Schneider, 19, of Jersey City, N. J., former holder of the junior-transcontinental record, and who won third place in this year's Ford tour, is going to do some streamlining on his Warner-Cessna. He expects to get about ten miles per hour more out of it then. This will help him out in races. Sometimes only a few miles per hour more means winning the race.

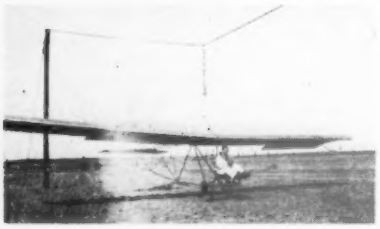
* * *

Arthur Romaine, 17, of the Jamaica Sea Airport, recently renewed his private pilot's license. In April he will be 18 and he expects to have two hundred hours for his transport pilot's license.

* * *

Al. Robbins, 19, of Roosevelt Field, Long Island, N. Y., recently won first place in a race from Roosevelt Field to the opening of the Providence State Airport in Providence, Rhode Island. The first prize was one hundred dollars and a large trophy. Al. flew a Warner-Cessna.

Boy Scouts Organize Eaglerock Glider Troop



Glider in the "sling" trainer.

MORE than twenty young Scouts are doing good turns now in the troop glider over the Alexander airport, Colorado Springs, Colo., and the lofty buttes of the Barrier range. And they have learned to "be prepared for the worst." That is, to keep plenty of speed. So far, the worst has not happened. A sudden landing has scratched up the Alexander glider now and then, but able hands make quick repairs and the gliding goes on.

The Eaglerock troop is the first organization of its kind in the Boy Scouts of America. It is rather an experiment. Its prolonged success probably will mean a national formation of Sky Scout troops corresponding to the Sea Scout system.

Like most momentous developments, the starting of the Eaglerock Glider troop was a slow matter. Under the leadership of Scoutmaster Charles Page, the troop was organized in January, 1930.

The boys forgot all about ice-skating and bob-sledding and toiled industriously every Saturday afternoon on the construction of the glider. By May, the glider had taken fairly definite shape. The first flight was made in June, 1930. Since then the club has made more than 300 flights and the glider is still gliding.

The glider is flown only by first class Scouts who have passed a brain-buzzing written examination, identical in some respects to that required of an applicant for a transport flying license. The examination covers aerodynamics, theory of flight, structures and rigging.

Scoutmaster Page, a private airplane pilot, is an assistant professor of engineering at Colorado College. His training and personality were well fitted to the job of initiating Sky Scout troops in America. He has worked out a glider training system that is both safe and progressive. Here is his system:

Once a scout has passed the written examination, he takes preliminary

(*Continued on page* 118)

Blind Children Inspect Airplane Model

BLIND children, like all other young folk, are interested keenly in aviation; but their affliction prevents them from grasping the various features of airplane construction unless they can actually handle model aircraft of a convenient size.

Recently the principal of a school for blind children wrote to the London airport, asking whether it might be possible to obtain a model of a modern airplane for instructional purposes.

This request was brought to the attention of Imperial Airways, and a model with a 2 ft. 6 in. wing-span of one of the company's Handley Page W.8 biplanes was sent off at once. After its arrival, the principal wrote:

"It is exactly the size for our purpose. Had it been bigger, the complete model might have been beyond the tactile comprehension of the smaller children; but as it is they are all able to feel the complete model within the length of their outstretched arms. The children are delighted with it."

Sees Rainbow Reflected on Clouds Below

Rainbow surrounding the shadow.

AMONG the strange tales told by aviators is that of seeing a circular rainbow while in flight above clouds. This phenomenon has been frequently observed in this country. Pilots report, that with correct conditions, the rainbow is projected against the clouds and the shadow of the plane is seen directly in the center of the circle.

But a mail-plane pilot now reports having seen an even stranger phenomenon. While flying the night mail-passenger plane on the west coast he saw a rainbow caused by the moon. This unusual sight was witnessed while the pilot was climbing through broken rain clouds to bright moonlight above. He described the moon rainbow as being ghostly but perfectly distinct.

XUM

Freddy Lund—Exhibition Thriller

by FRED LUND *as told to*
LEGETTE BLYTHE

This is this famous stunt flyer's last article before his death.

I'VE been fooling with airplanes a long time—ever since way back in 1917. That's a long way back in the history of aviation, too. I've fooled with them all over this country—and a lot of others. I hope to keep on. I just naturally like airplanes. I like to take ships up and see what they will do.

Of course I may get bumped off—exhibition flying isn't exactly as safe as keeping books—but in those fourteen years I've been flying, I have learned a lot of tricks about taking care of myself. And the more hours a flyer has in the air, the less foolhardy he becomes. But that is getting away from my story.

Picking out my greatest thrill is a hard job. I've had a lot of them. But there is a lot of difference in thrills. Some of the things that thrill the folks on the ground, for instance, are like chopping wood to me when I am up there doing them. And some of the things that look mighty tame to the fellow below give me a great kick.

Sometimes a thing happens so quickly that you don't even have time to get thrilled. Or maybe, the thrill comes after you have changed from your flying togs and are on the way home from the flying field.

The day that my ship caught on fire when I was a mile up over some particularly ragged mountains, so that I had to come down in a side-slip to blow the fire outward from my motor, didn't give me much of a thrill until I had landed and put out the fire. I was too busy.

Another few seconds and my motor would have dropped out. As it was, I had to get another one before I could get away. Well, thinking about that after it was all over, I'll admit, has frequently given me a thrill and the creeps.

The first outside loop was not the tamest thing I ever did, either. I was the first person to do it in an ordinary commercial ship. Nobody knew whether a commercial job would stand the tremendous strain imposed on a ship while doing the outside loop. It would probably crack under the strain some folks said. Others suggested that the motor would fly out. Some said I would.

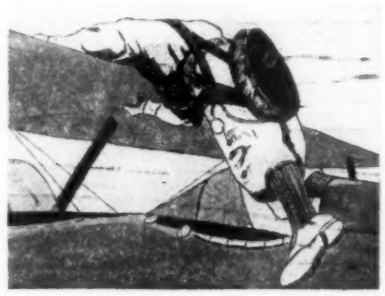
The factory wanted to know. So I went up to find out. Well, the motor didn't and I didn't.

I was the third flyer to outside loop. Jimmy Doolittle and Al Williams were ahead of me. Since then—my first outside loop was made on October 20, 1928—I have done hundreds of them. Never a month passes that I don't do at least one to keep in practice. I always get a kick out of it. Sometimes too much—the one I had started out to tell about for instance.

Freddy Lund, the fearless stunt flyer, and chief test pilot of Waco, just before his death. Eddie made aeronautical history, and was the hero of thousands who witnessed his wonderful acrobatic flying.

Betty Lund, my wife, who is also an exhibition flyer and is best known for her adeptness at barrel rolls, was with me at the time. At least, she was on the ground under me. We were at Cincinnati—out at Watson field.

IT was in June, I believe, and on the very day that my good friend "Speed" Holman was killed out in Omaha. There was a huge crowd out at the airport and I was feeling first-rate. I had made up my mind to give them their money's worth.



Illustrating how Freddy Lund was thrown out of his cockpit and on the top wing, during an outside loop. The moral reads: "Test your belt before every flight."

Well, my conscience has never worried me on that score. I feel like they were overpaid.

And as with every other close call, I learned a lesson from that afternoon's workout at the controls. Every time I go up now, I am strapped in with two—not one, remember, but two—safety belts.

Each one is tested to withstand a pull of 2,300 pounds, and I am a comparatively little fellow too, weighing only 135 pounds. And believe me, I will never go up again to do outside loops and outside spins, (the latter being my specialty), without being tied in there, and tied to stay.

That afternoon, I gave the ship a perfunctory examination, climbed in, gave her the gas and was soon up three thousand feet. The crowd was below and slightly to one side. I was performing above the field adjoining the airport, for I never stunt directly over a crowd. I gave them some rolls, spins and other stuff, and was working up to the outside loop which was a comparatively new thing and had been advertised as the day's feature.

In preparation for the loop I climbed another three hundred feet. I then flew off a half mile or so, banked her and came back roaring across the field for the dive that would take me around the circle to the top and then across again to complete the loop.

Have you ever ridden a roller-coaster at a carnival? Well, compared with that roaring dive, over, down and under, with yourself on the outside of the turn and at a sickening speed that threatens to tear your very fabric off—that roller-coaster dive is about as tame as sitting on the front porch Sunday afternoon. The outside loop wasn't made for sweet Willies.

As aviation fans understand, the outside loop is a giant circle in the air, perpendicular with the earth, and with the pilot on the outside of the turn instead of on the inside, as with the ordinary loop.

When you swing a bucket of water, the motion keeps the water in. It presses it against the bottom. In the same way, when a pilot is doing the ordinary loop, he is on the inside of the ship and his weight presses downward against the seat. The swing itself holds him in.

But now consider the whirling bucket again. If the bucket happens to be on the edge of the shelf when you pick it up, and there is a fly sticking on the bottom, what sort of a chance

will he have of staying on when you whirl the bucket over your head? That's the way with a pilot doing the outside loop. He is on the outside of the whirling ship. If he is not tied in properly, well, it's likely to be just too bad.

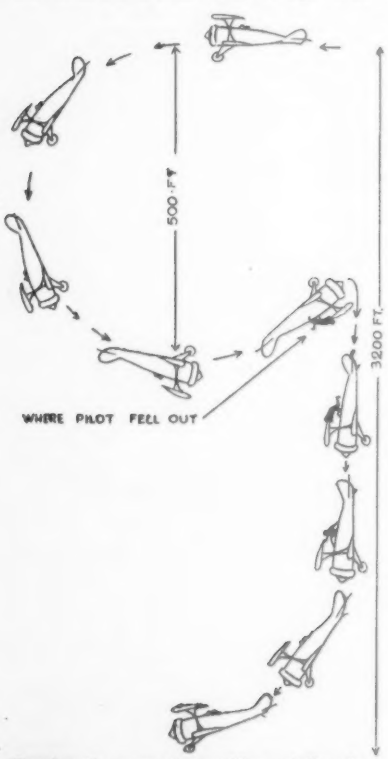
WELL, to get back to my story. I roared across the field, I went over into a headlong dive, gained tremendous speed, came under upside down, being held in during this time by my safety belt. The belt was straining under the terrific pressure that was striving to hurl me outward into dizzy space, and I was rising to reach the top of the loop to complete the swing—when something happened.

Instantly I was hurtled clear of the cockpit. The first thing I knew, I found myself jammed against the wing—my shoulder hooked against the wing and my feet hanging on the edges of the cockpit.

Something had snapped.

I knew I was in an awful predicament. "Freddie," I said to myself, "old man, if you don't get back into that seat and do it in a hurry, it's the curtain for you and the junkpile for $9,000 worth of sweet-flying stuff." I say that I said that—I don't suppose I did. I guess I said it after I landed the $9,000 worth of sweet-flying stuff.

Well, here I was, three thousand feet up, the wind knocked out of me and doing an outside loop *outside* of the cockpit. That was surely one outside loop. I suppose I'm the only fellow who ever did a real outside loop. I was certainly outside in every sense of the word.



Showing the successive positions of the plane during an outside loop. Note that the force tends to throw the pilot outwards.

And now, what to do?

When that snap came, I was hurtled violently forward from the cockpit. But for a moment I had held on the stick—until I was thrown clear of everything—and this pulled the stick backward and threw the ship into a dive.

She nosed over and started for the ground with the motor wide open—we were doing 175 when I went out—pulling the ship straight down with a sickening speed that picked up as the motor raced faster and faster. We were going faster than gravitation would take us. The motor was fairly racing us to the ground. Man, we were taking a buggy ride!

I hung to the wing. I was falling, of course, with the ship but no faster. Then, too, the vacuum created by the air rushing over and under the wing, held me on in a sort of pocket. If I jumped—I had a parachute, of course—I didn't know what would happen. I couldn't drop faster than the ship. I might not be able to clear it. And the rudder might rip me to ribbons if I turned loose.

Then there was that $9,000 ship. It hadn't done me wrong. I know that. It had been my fault. I had been careless in not inspecting it more thoroughly before going up. I hated to lose the old hack. And $9,000 wasn't to be picked up in the road every day, either.

SOMEHOW, I clambered back into that cockpit. When she started the dive, and as I have said, we were three thousand feet up. I had started the loop three hundred feet higher and the diameter of my loops, I figure, is about five hundred feet. I had climbed back two hundred of this, I guess, when the thing happened.

We were racing to the ground. Probably making two hundred miles an hour. The motor was wide open with nothing to hold it back.

I got back in. Grabbed the stick—boy, but the old stick in my fingers felt good to me!—pulled her up and sailed out into a glide, barely five hundred feet above the ground. That had been a wild half-mile ride downward.

I landed her on the port. Then, I let out a sigh. I guess it came all the way up from my heels.

Betty, several helpers and a bunch of spectators came running over. Betty knew that something was wrong for she knew that I never dived like that. No, sir!

When they got to the ship, I held up my safety belt. The steel cable, that had held the belt, had become worn down under the seat where I had not noticed it. The tremendous pressure of the loop had snapped it.

Betty saw it all at a glance. She gave me one of those once-overs. If you are married to a stunt flyer, brother pilot, you understand the sort of once-over I got.

"Well," observed the wife, as only

(*Continued on page* 126)

Picking Up The Mail Bags

Plane in the act of catching mail bags.

A NEW aerial pickup device, which will permit a plane to take on sacks of mail or other articles without slackening its flight, was successfully demonstrated at the Washington Hoover Airport, Washington, D. C. The device is the invention of Godfrey Cabot, formerly president of the National Aeronautic Association, and A. W. Card, a World War veteran.

The photograph shows the pickup in action. The hook, suspended from the plane, has just engaged in the cord, carried by the two poles on top of the truck. The catapult is projecting the mail bag into the air.

Flies Into Baby Tornado

PROCTOR NICHOLS, chief engineer of the Alexander Aircraft Company and a private pilot, had the unusual experience of flying into the birth throes of a young tornado while flying a light Flyabout cabin monoplane back to Colorado Springs from the National Air Races at Cleveland.

Nichols was coursing along at 100 miles an hour with a 15 mile per hour tail wind. Later, he hit a 30 mile an hour wind from the southwest, and a powerful convectional current arose where the two winds met. From 500 feet above the ground, the Flyabout was thrown violently upward to 1,200 feet.

At the crest of the upshoot it then fell into a downdraft which shot it down to 400 feet. Outside of the rapid elevator effect, Nichols declared he experienced no trouble with the lightplane. Reports later told of a small tornado damaging barns and livestock in the vicinity near the Nebraska border of western Kansas.

Long Distance Visibility

PILOT A. L. Gilbousen of United Air Lines claims the long-distance night visibility record. He saw the lights of Reno, Nevada, at midnight while flying at an altitude of 13,000 feet with mail and passengers over Redding, California, which is 175 miles from Reno and on the opposite side of the Sierra Mountains.

XUM

Air Mail Becomes More Popular

THE cost of transporting domestic air mail, per pound and per mile flown, has declined sharply in the last seven years. This is largely the result of increased efficiency in airline operation and the growing volume of mail, express and passenger traffic.

It cost the government $11.80 for each pound of mail carried over the transcontinental route operated by the Post Office Department in the fiscal year 1925. Today, under the contract system, the cost of moving the mail per pound is $1.99. In 1925, also, the cost per mile flown was $1.30. It is now 80 cents.

Locking Device For Propellers

AN INVENTION, designed to protect metal airplane propellers of the removable blade type against centrifugal force, has been patented by Ole Fahlin, Sioux City, Ia.

A flexible key, having the appearance of a metal band sawed into segments, and inserted into the aperture of the hub proper, is the basis of Mr. Fahlin's

Ole Fahlin and the propeller provided with the special locking device.

invention. The key, after being pushed through the opening and fitted into the keyway on the propeller shaft, is securely fastened with wire. The groove in the blade and the groove in the hub register, thus allowing the flexible key to bind the two pieces of metal solidly together.

Rocket Driven Glider is Successful

Rocket driven glider in full flight, leaving trail of smoke behind.

WILLIAM G. SWAN, 29, is shown at the controls of his rocket glider as it took the air in its first test before a throng of more than 2,000 persons. The glider was equipped with two sets of rockets—six to a set—each rocket producing pushing effect of fifty pounds. The rockets were set off by apparatus in the cockpit and despite strong winds, the glider took off at a speed of about 35 miles an hour and attained a height of 200 feet.

Students Patrol Forests

AVIATION has contributed to the annual battle against forest fires, and the Santa Barbara National Forest is one of the best patrolled of government forest reservations in our country. It extends 300 miles from Salinas to Ventura County line in California, and from the coast to 125 miles inland.

Student fliers make regular flights over the Santa Barbara National Forest area to report any fires that may be noticed. Major McBride, commanding officer of the college, explains that they are able to provide this service to the forest supervisor without charge or obligation because it gives their cadets a training which they must have anyway.

Arrangements for the forest fire patrol, and the emergency use of the specially equipped Hancock School plane, have been worked out with the forest supervisor of Santa Barbara and a forest ranger stationed at Santa Maria.

The short-wave aircraft set on the Ryan plane of the Hancock School is a combination code and telephone unit powered by battery and carrying a seven and a half watt transmitter. Conversation can be carried on with headquarters from a distance of 100 miles.

A Mobile Mooring Mast

A $119,000 contract for the construction of a mobile mooring mast at the Naval Air Station, Lakehurst, N. J., has been awarded by the Bureau of Yards and Docks, Navy Department.

The mobile mooring mast is of the type that moves over a pair of standard gauge railroad tracks. In it will be embodied the experienced gained through the use of a similar mast recently delivered to Lakehurst, as well as experimental features developed by the contractors for this mast.

The mast will be delivered to the Naval Air Station, Lakehurst, in about seven months, where it will be installed and tested. Later, it is contemplated that it will be disassembled and shipped to Sunnyvale, California.

The Revised Hornet Engine

AMERICA'S most powerful radial air-cooled airplane engine, the new high compression supercharged geared Hornet, has successfully completed block and flight tests necessary to secure an approved type certificate.

Although developing 775 h. p. at sea level, this new engine will retain the 575 h. p. rating of the standard Hornet of which it is a modification. It has been designed primarily for military bombing planes and can deliver a full 575 h. p. output up to 8,000 feet.

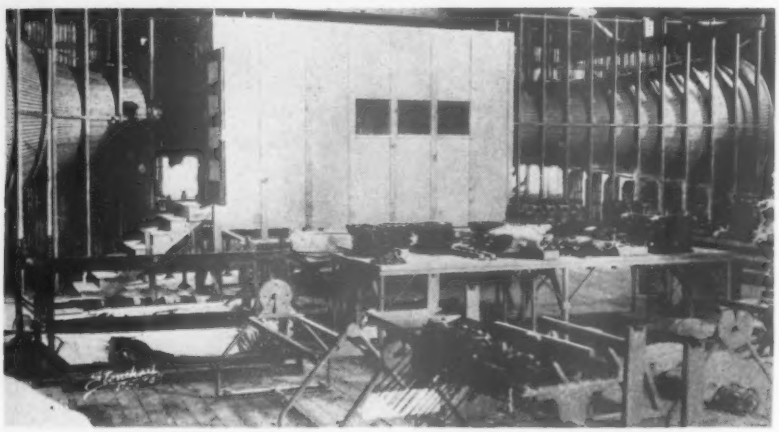
This increases its utility as power unit for planes carrying large pay loads over mountainous country or altitudes higher than normal commercial operation.

Wind Direction Indicator

Dirigible type wind indicator.

THIS novel wind direction indicator was recently erected at Heston Aerodrome, England. It is in the form of an airship. The position of the nose of the model indicates the wind direction, thus assisting aircraft in landing. The new device is easily visible from the air.

Model Tests Conducted in College Wind Tunnel



Wind tunnel for making aerodynamic tests on models. The model is placed in an air stream of known velocity.

AN UNUSUALLY efficient wind-tunnel, by which models of new airplane designs are tested, has been completed by the Hanock Foundation College of Aeronautics.

Manufacturers and designers of airplanes may have their models tested without charge; and experiments are made by officials of the school relating to every conceivable maneuver and operation to which a plane might be subjected in actual flying. From these experiments scientific data are assembled and a report made to the designer.

American Plane For Prince

THE airplane is solving many of India's problems of distance, playing an important part in its interior development, according to Prince Bahadur Dossabhoy, J. P., of Bombay.

The prince, himself a pilot of wide experience, made a special trip to the

The Prince inspects the cabin plane which he purchased in America.

United States recently for the sole purpose of obtaining an American built airplane. After inspecting a number of ships he purchased a four-passenger cabin monoplane, powered with a 215 h. p. motor.

The prince has owned several other planes, but decided he could find a better one if he came to the United States and made the selection personally.

This, together with many other similar incidents of recent date, rather indicates that American aircraft is gaining recognition the world over.

Mapping Contract Closed

AN AERIAL mapping contract presenting unusual difficulties has just been closed with the Denver division of the United States Forestry Service for the mapping of a 700 square mile area, cut by the Great Divide, in the vicinity of Gunison, Colorado.

The map, when completed, will be what is known as a "grazing" map, on which all highways, grainage, wooded and cleared areas will be accurately plotted and from which the Forestry Service can determine the acreage available for cattle grazing and the number of cattle that can exist in the territory. In addition, the map will serve as a base for forest fire protection, showing every trail, stream, highway and accessible means of locating and reaching a fire.

The physical characteristics of the country add greatly to the difficulties of the job. The lowest elevation is 9,000 feet, while the highest is something over 13,000 feet. It is estimated that the average ground elevation is 10,000 feet above sea level, which necessitates the use of high powered equipment, as the map itself, to be economically produced, must be photographed from an elevation of 20,000 feet. This will require the use of oxygen by both the pilot and the cameraman. A four-place Cessna powered by a super-charged 300 horsepower Wright Whirlwind motor will be used.

The plane doing the work will fly about 4,000 miles back and forth over the area, and more than 2,500 separate exposures will be required.

A New Radio Range Beacon

A NEW instrument for the reception of guiding signals from radio range beacons has been developed by the United States Bureau of Standards for the use of aircraft. A pointer now replaces the vibrating reeds which were used in the earlier visual-type receivers.

For this reason, the device can be used more effectively to combine the directional beacon signals with those from the high-frequency fog-landing beam indicator. These swiftly developing radio aids to flight—with television for the pilot and actual radio control of aircraft—is likely to be in use within a short span of years. They are evidence that weather hazards eventually will be banished from aviation.

New York Has Air Cops

INITIAL steps in the formation of an aeronautics branch in the Department of State Police, New York State, was made recently with the purchase of a three place biplane.

The ship is painted in the traditional gray color of the State troopers, the fuselage being a dark gray while the metal work is done in black. The wings are yellow, and adorning each side of the fuselage are replicas of the State seal.

Since the delivery of the ship, Lieut. Hughes has used the plane in locating several missing persons and hunting down a criminal who was hiding in a deep patch of woods. He was successful in each case.

The police ship is also equipped for radio installation. It is the plan of Lieut. Hughes to install a short wave receiving set in the plane and he has already built a small sending set at the State Police barracks.

Under the State laws and the De-

Airplane police "patrol-wagon."

partment of Commerce air regulations, Hughes is given the work of seeing that no pilots go "haywire" in New York State. He has started inspecting the 88 airports in New York State and is making an index system, giving the license number of every ship owned and operated in the state.

According to Major John A. Warner, superintendent of State Police, additional planes will be added to the branch as rapidly as they are needed. It is expected that a transport ship will be secured next year to use in transporting troopers to various sections of the state on emergency calls.

XUM

Buying an Engine for the Lightplane

by J. B. ROBERTS

A candid discussion of the engine problem that confronts every lightplane constructor or the builder of a powered glider.

EVERY aspiring lightplane builder, by some inexorable law of nature, must sooner or later bump smack into the engine problem. And what a problem it is!

He generally tackles the job from the wrong end, building the ship first and then trusting to luck that he will pick up an engine somewhere that can be adapted to the misfit crate.

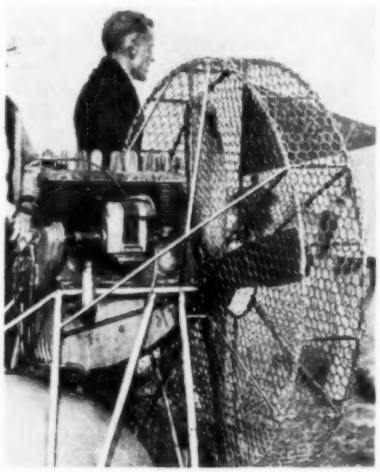
Too bad. This bird has a whole lot of experience and work coming to him, to say nothing of the expense and delay due to tearing the ship down and making various and sundry alterations for the engine fittings.

Far-sighted and level-headed amateur constructors, who seem to constitute only about ten per cent of the total number of builders, investigate the engine problem at the beginning, and then build the ship of their dreams about this engine. Somehow and some way, these fellows get the engine into their hands before they start sawing boards, and save themselves a whole lot of time, expense and gray hair. It doesn't make any difference whether the engine came direct to them from the builder, whether they got it second-hand or whether they traded in a wheel-barrow for it. They at least have the engine.

Lack of an early decision as to the type and size of engine to be used, has filled the country full of derelicts and weatherbeaten skeletons standing out behind barns and the other ignoble structures placed at the rear of the lot. If we were to go into the statistics of the subject, we could account for literally thousands of engineless craft standing around in disuse, just because their owners had dodged the engine issue until it was too late.

Now, after a good many years of experience with the homebuilding branch of the airplane industry, I have divided these birds into four principal groups—so far as airplane engines are concerned. First, we have the fellow with the Ford complex who believes that he can save a whole lot of money by getting a Ford engine from a junk shop and rebuilding it. After a dint of work, a whole lot of perspiration and a big expenditure of money—it may takeoff. That's about all.

Next, up steps No. 2, who is of an inventive turn of mind. His scheme is to design and build an original engine, which, of course, will be far superior to anything on the market in respect to economy, power and speed. He has never had anything to do with engines before, at least in designing them, but this makes no difference to this poor sap. He generally gets a few wood patterns made, and a few castings from



A sugested method of mounting the engine and for protecting the propeller on a light plane. This is one of the "safety first" features to be adopted.

them, before his pocketbook runs out. And he is still a long way from flying.

AND now we come to the safe and sane builder who buys a new standard engine of known performance from a well known builder. The prices in the catalogue may seem pretty stiff, but take it from me, they are a whole lot lower than cost arrived at by either of the foregoing methods. It may come as a surprise to some amateurs, that an engine builder with an experienced engineering staff and a fully equipped shop, can build a better engine than an amateur can build in a barn with a hatchet and cross-cut saw, but such is the truth. And as for Ford conversions —phooey!

Next, we put on act No. 4, which is really a version of act No. 3. This man buys or trades in for a second hand engine, which is not at all a bad stunt if he is only a fair judge of engine condition. As a rule, it is comparatively easy to get an engine in good condition, with only a few hours on it, from someone who is retiring permanently from the lightplane industry.

As a matter of fact, I have seen at least 100 standard engines in their original crates that have been offered for less than one-third the list price. Even though these engines may have lost their pristine glitter, and are somewhat frayed around the edges—so to speak—they are immeasurably superior to homemade products of any sort.

With all this dope stored away in our mental processes, we are about to face the first big issue in the campaign. What horsepower will be necessary to drag our plane through the air at a good clip? And right away, I answer, that this depends entirely upon the ship that you are to build or the performance that you expect from it. Under conventional rulings, a lightplane is one that will fly satisfactorily, and with a factor of safety, using 50 horsepower or less—mostly about 35 to 40 H.P. If the power requirements are greater than this, it can hardly be considered as a lightplane.

With engines inside these limits, we cannot reasonably expect single-seater speeds much in excess of 100 miles per hour unless the ship is unusually well designed. Two-seaters, equipped with a 35-40 H. P. engine, generally are doing well at 80 to 90 miles per hour—top speed. With smaller engines, say 20-25 H.P., a speed of 60 M.P.H. will be fair performance, although exceptionally well designed ships have shown better than this. One diminutive single-seater ship, shown in a recent issue of POPULAR AVIATION, has a record of 140 M.P.H. with 20 H.P., but this is far above the general average.

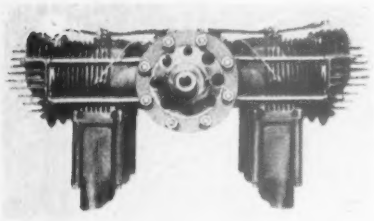
It is a great mistake to install a very small engine into any ship, because there is no power reserve in case of heavy winds, a partially disabled engine or similar troubles. If all of the power is eaten up to attain a speed of 60 M.P.H., then there will be no power available for climbing—and climbing ability is one of the essentials of a ship. Horizontal flight resistance takes the first toll from the engine, and if there is any excess of available power after the ship has reached flying speed, then it is this excess that climbs the ship.

Anything from two up to nine cylinders have been applied with success to lightplanes, and just as a little tip, the smaller the number of cylinders, the less parts there will be to get out of order and service. The writer has seen some wonderful little ships propelled by two or three cylinder engines, and, as a rule, four cylinders are ample for any lightplane in ordinary service. Five to nine cylinders, of course, give smoother running and better explosion balance, together with a somewhat better propeller efficiency, but this need not bar you from using a smaller number.

THE four cylinder "in-line" type has proved successful with lightplanes during the past few years, the cylinders of these engines usually being motorcycle engine parts, although the cylinders of several makes have been designed specially for the purpose. They

are air-cooled, of course, and are quite simple and inexpensive to service. The engine of the well known "Gypsy Moth" is of this type, although somewhat larger than the average American four-cylinder in-line type. They run with comparatively little vibration and present very little frontal area to the wind stream, presenting a correspondingly low head resistance.

From the beginning of aviation, there

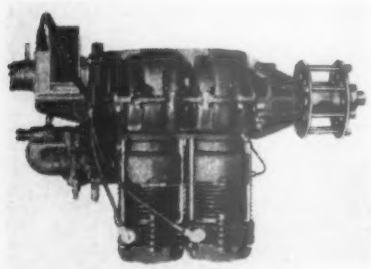


Two-cylinder opposed type engine.

has been a controversy between the supporters of the air-cooled and water-cooled systems, and this argument has not been solved in its entirety even today. However, where the lightplane is concerned, simplicity is generally the paramount issue and for this reason the air-cooled engines predominate in the lightplane field. When we get up to the large sizes, then the air-cooler is not always supreme.

Air-cooling eliminates the complication and uncertainty of the water-cooled engine. We avoid radiators, water, the various connections and plumbing, and generally, the engine is made more reliable by the absence of these parts. On the other hand, the water-cooled engine is more compact, presents less frontal resistance and is capable of more consistent operation through wide variations in atmospheric temperatures.

Finned, air-cooled cylinders, presented to the wind stream, cause a



Two-cylinder, two-cycle, inverted type engine.

great deal more air resistance than a well designed water radiator. In the lightplane, however, where the speeds are comparatively low, the resistance factor is not so important as when the speeds run above 100 M.P.H.

In the choice of a lightplane engine, maintenance cost is probably the most important of all the factors concerned. Fuel economy, oil economy and vibration are usually secondary to the cost of upkeep. Continual repairs, adjustments and overhaul eat into the pocket-book more rapidly than any other expenses.

As the lightplane is primarily for the reduction of operating expense, it is defeating its own purpose if the engine is not sturdy and reliable under all ordinary flying conditions. A gasoline hog is a far better proposition for the lightplane owner than a delicate and efficient engine that is always undergoing repairs and adjustments.

While engine weight is of importance, yet a few pounds one way or the other should not influence the choice of any engine when the weight reduction is known to be attended by impaired sturdiness and reliability. A very light engine, of course, is an asset in respect to carrying capacity and cruising range, but if the few pounds means sacrificed stability, the engine should be rejected. Skinning down the engine weight was formerly more popular in years gone past than at present, I am glad to say, and the majority of engines on the market are fully able to make a creditable showing.

Engine weight is a dead constant weight that consumes fuel for its support and it therefore reduces the carrying capacity and cruising range of the ship. This is not of such great importance with a lightplane, however, as it is with a larger ship, because the lightplane is seldom used for long distance tours or for commercial transport. Fuel economy, for the reason that the efficiency of the engine affects the weight of the gasoline carried, is of more direct importance than the weight of the engine itself. However, for reasons mentioned, the weight of either the lightplane engine or the fuel is not a prime consideration if they compromise other and more important factors.

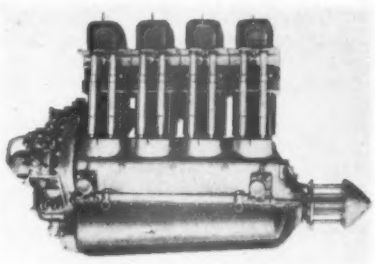
AND, very strange to say, the lubrication system of the engine generally receives very little attention from the prospective purchaser, yet it is one of the vital auxiliaries that speak for the success or failure of the power plant. If the oil is not directed in the proper quantities to the various rubbing surfaces, then the repair bills will run up into big figures and engine failures will predominate.

The bearings of aeronautical engines are high-duty bearings; they run at high rubbing speeds and under exceedingly high pressures, calling for the utmost in lubrication. The temperatures are higher than with automobile engines, because of the higher compression, so that the lubricating system deserves the closest consideration.

This high temperature operation calls for exceedingly viscous, heavy lubricating oils in most of the engines now on the market, but perhaps some day an engine designer will lay out a bearing system that can be lubricated with ordinary motor oils. When this is done, much of the trouble and expense incident to present systems will be eliminated. Expensive high test aviation gasoline, together with special aero engine lubricants, all go to make aviation an unnecessarily expensive pastime.

The valves of some engines require little attention, while with other makes the necessity for continually working on the valves takes away much of the pleasure of flying. While the valves may seem to be insignificant details to the beginner, yet they are really of major importance and should be studied before buying any particular make of engine.

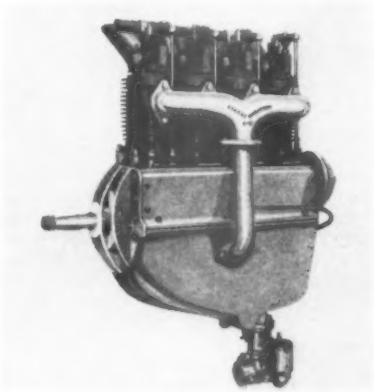
As you all know, the main bearings



The Four-cylinder "Gypsy" engine.

of an engine are called upon to meet two heavy stresses. First, the so-called "transverse loading" due to the pressure of the pistons. Second, the end thrust due to the tractive effort of the propeller. The latter force acts in a direction parallel to the shaft and requires adequate thrust bearings. If suitable bearings are not installed at the propeller end, then there will be trouble from a number of sources. Most in evidence will be a bent shaft or a propeller running out of track. Either of these defects causes vibration, and ultimately a crystallized shaft with a possible breakage of the crankshaft.

Carburetion, or the mixing of the gasoline vapor with the air, has been highly perfected. In addition to the carbureter improvements themselves, the method of installing the carbureter,



Church four-cylinder light engine.

heating the intake air and the location of the carbureter have received expert attention. Such carbureters, it is true, still refuse to digest ordinary plebian nine-cent motor gasoline, but at the same time, give good results and fair economy.

(*Continued on page* 113)

XUM

Question and Answer Department

All questions of general interest on any phase of aviation will be answered authoritatively by Popular Aviation's Technical Staff.

AS BEFORE, this department is open to all of our readers who wish information on the general subject of aeronautics. Its columns, however, are restricted to the discussion of aircraft construction, flying, maintenance and the principles of operation.

We cannot, obviously, undertake the solution of engineering problems nor can we answer questions requiring much research work. However, we do solicit such ordinary questions as might arrive in your everyday experience and which are of common knowledge in the craft. Address all letters to the Question and Answer Department, POPULAR AVIATION, 608 S. Dearborn St., Chicago, Ill.

* * *

QUESTION:—Dell R. Richert, Des Moines, Ia. *After my engine has been pulling hard for a couple of hours, it will not stop as soon as I turn the ignition switch to the "off" position. What is the cause of this trouble?*

Typical slotted wing with aileron.

Answer:—THIS trouble is undoubt due to overheating, the carbon in the cylinder or some other part of the combustion chamber becoming red hot so that it ignites the charge without the aid of the ignition current. Excessive carbon deposits, deficient water circulation in a water-cooled engine, obstructions in the way of the air circulation, or similar defects, will cause the trouble. This should be cleared up immediately as it may lead to more serious difficulties in the future.

* * *

QUESTION:—George Vechas, Pittsburgh, Pa. *We are converting a Ford Model "T" engine into an aeronautical engine. After lightening the engine up by the removal of certain unnecessary parts (unnecessary for an airplane), the engine seems to lack the necessary "pep" and power. Just how can the power be increased so that the engine will propell a light plane satisfactorily?*

Answer:—YOU have undertaken a hard job in making this conversion because the Model "T" was never intended to be an aeronautical engine in the beginning, and is as ill adapted to this job as any we know of. In the first place, the compression must be increased, either by planing off the top of the cylinder block or by the use of special long connecting rods.

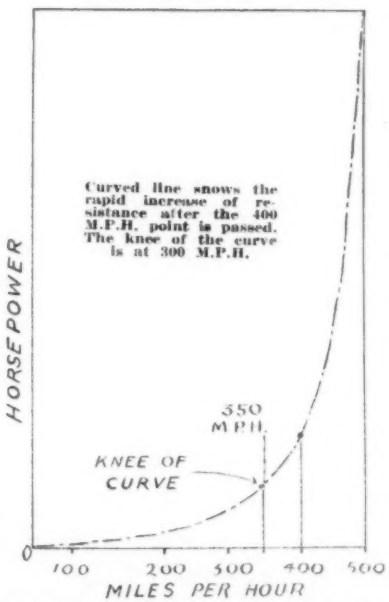
Next, it will be necessary to change the valve timing, and this is not such an easy job unless you can get hold of one of the special racing cam-shafts built for converting Fords into racing cars. Building a new cam-shaft is no job for the amateur mechanic. The valves must lift higher, than in the standard Ford, and this in turn requires stronger valve springs so that they will close quicker.

To eliminate vibration requires aluminum alloy pistons, and a careful rebalancing of all the rotating and reciprocating parts. An average stock Ford runs so rough that it will be likely to tear the ship to pieces unless it is rebalanced. Using a higher compression calls for Ethyl gasoline or similar high grade anti-knock gas. This is a tough job.

* * *

QUESTION:—Henry Frankel, Milwaukee, Wis. *I have read in various publications that an airplane will take off and land at very low speeds—comparable with the performance of an autogiro—if a slotted wing is used. Just how is a slotted wing built and why does it permit of such performance?*

Answer:—AS WILL be seen from the accompanying diagram, the leading edge of the wing is provided with a guiding vane, commonly called the "slot," which controls the air flow over the top of the wing surface. This automatically prevents the air breaking away from the top of the wing at high angles of attack, and thus extends the lifting effect of the wing when the speed is materially reduced. At the rear edge of the wing is usually placed a continuous hinged aileron extending the whole length of the wing.

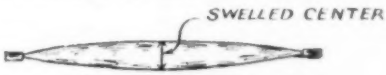


Graph showing the relation between the horsepower and speed of an airplane. Horizontal scale is speed. Vertical scale represents horsepower.

With the slot guide, and the aileron working in conjunction with one another, the lift does not fall off when the angle is greatly increased, and at high speed, the slot and the rear aileron are readjusted so that the wing performs its normal functions. I have seen ships arranged with this wing combination take off and land in a 100 foot circle.

* * *

QUESTION:—Fred C. Caruthers, Davenport, Ia. *I notice that the interplane struts of biplanes, and the landing gear struts are thicker in the center than at the ends where they are connected. Does this give less resistance or has it to do with the strength of the strut? Is there any simple method of determining just how thick the center of a strut should be?*



Unilateral interplane strut.

Answer:—ALL struts, or members placed under a compressive stress, tend to fail by bending at a point near the center, the bending tendency decreasing near the ends of the strut. Therefore, to perfectly adjust the material to the stresses, and to reduce the weight to the lowest practicable point, the struts are made thicker in the center where the bending moment is the greatest. At the ends, the struts simply resist a crushing stress and can be made much smaller.

Yes, this arrangement is also of assistance in reducing the air resistance. The average thickness of the strut in the wind is less, of course, and this in turn is effective in reducing the effective presented area.

* * *

QUESTION:—John Sturm, Phoenix, Ariz. *How are steel fuselage tubes protected on the inside against rust? I should think, in the course of time, that this steel tubing would rust through—or at least be weakened by the action of moisture.*

Answer:—THERE are a number of methods for protecting the inside of steel tubing against rust, but the simplest and possibly the most effective, is to oil the inside of the tubes and then cap them so that none of the oil will escape. On hot days, the oil vapor will gradually distribute the oil uniformly throughout the tubing, thus eliminating much of the tendency toward rusting and corrosion.

* * *

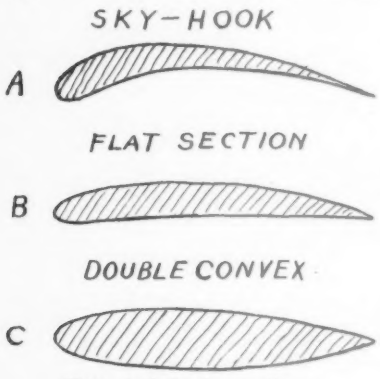
QUESTION:—Charles Underwood,

Chicago, Ill. *Is the Clark "Y" wing section suitable for glider wings? Has this wing section ever been used for this purpose?*

Answer:—THE Clark "Y" wing section has given satisfactory results in many gliders and light planes. It is an all-round wing section having about as many desirable factors as any wing that we know of, except perhaps, for sailplanes employed for soaring. And, there is another factor almost as important—the ribs are comparatively easy to build.

* * *

QUESTION:—Robert K. Matthern, Grand Rapids, Mich. *I have been following the dope on the Schneider Trophy Races lately, and I have noticed that the horsepower of the engines is building up much more rapidly than the speed. Is this due to poor design and construction in the recent ships, or is it due to some other cause? It would seem to me that doubling the power would double the speed of a ship—at least approximately.*



Three typical wing sections.

Answer:—UNFORTUNATELY, the horsepower increases at a rate much greater than the speed, hence the great difficulty experienced in squeezing out the last few M. P. H. Up to about 300 M. P. H. the horsepower varies as the "cube-of-the-speed." Above this speed, the power requirements for overcoming the air resistance increase at even a more rapid rate, until at the speed of sound (1,060 feet per second), the horsepower varies approximately as the fifth power of the speed.

This law is indicated by the graph attached. It will be seen that the curve increases the horsepower very slowly up to about 300 M. P. H. Then at a little over 400 M. P. H., the curve shoots straight up so that the horsepower is enormously higher at 500 M. P. H. than at 300 M. P. H.

This is due to a change in the physical condition of the air above 300 M. P. H. so that the power jumps clear up out of sight when we get to above 450 M. P. H. It is for this reason that it is very doubtful whether speeds much above 450 M. P. H. will ever be attained with engines or ships of the present type. We do not say that 500 M. P. H. is impossible, but we do claim that it will call for a radical departure in the present engine and ship.

* * *

QUESTION:—Karl Frieze, Spokane, Wash. *What is Ethyl gasoline made from? Is it a special gasoline all the way through, or is it made by putting chemicals into the gasoline? Whatever it is, I'll say that it is the berries when it comes to doing the work.*

Answer:—ETHYL aviation gas is simply a high grade aviation gasoline in which tetra-ethyl lead is dissolved, together with a small amount of light lubricating oil and a solvent for lead oxide. Almost any salt of lead will suppress detonations and knocking at high compression pressures. The tetra-ethyl, however, is the best lead salt for the commercial production, hence it is used almost exclusively for the purpose.

When tetra-ethyl lead is burned in the cylinder alone, it is likely to cause deposits of metallic lead upon the valves and spark plugs, hence a second chemical compound is included with it to void such deposits. The lubricating oil is for more perfectly lubricating the valve stems, but has nothing to do with the performance of the gasoline.

By suppressing the detonations in this way it is possible to employ a higher compression pressure than with ordinary gasoline, and by the employment of a higher compression, the horsepower output and the efficiency are much improved.

There comes a time, however, when the ordinary percentage of tetra-ethyl lead has little effect upon the detonations, with the compression raised above normal, and then something else must be done about the matter. From this point on, such compounds as toluol, alcohol or aniline must be employed to take care of the explosions.

* * *

QUESTION:—Frank J. Stockton, Elmira, N. Y. *I have closely examined a number of propellers recently, and note that the portions of the blade nearest the hub are turned at a greater angle than near the tip. Why is this done? Does this give greater pulling power or does it have some other effect?*

Answer:—WHEN a propeller is in flight, it travels along two directions at one time—so to speak. In the first place, all points on the blade revolve about the center of the shaft in a circular path. Secondly, the propeller, as a whole, moves forward with the ship. This means that any point on the blades actually moves in a direction that is a compromise between the two lines of motion—a line called the "resultant."

The angle of the blade depends upon the relation between the distance traveled in one revolution in the circular path and the distance traveled forward (pitch) during the same revolution. This is made clear in the accompanying diagram, where it will be seen that the tip passes along a helical path while moving forward.

A point taken at the center of the blade, or nearer the hub, travels the same distance forward in one revolution as any other part of the blade, but as this point is revolving around a smaller circle, its circular distance is less. Therefore, the angle of the blade at the inner point must be greater than that near the tip so that all points on the blade will pass forward through the air at the same time. At the exact center of the hub the blade face will be, theoretically, at a 90 degree angle.

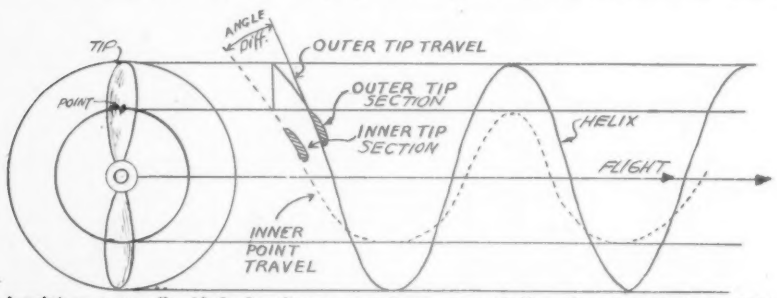
Very high speed ships, such as those used in the Schneider Trophy race, are set at a very great angle—almost at right angles to the plane of rotation. As a result, they have very little thrust or pulling power when the ship is standing still or moving slowly, but gradually pick up thrust as the speed increases.

* * *

QUESTION:—W. H. Graffis, Muncie, Ind. *What is meant by the expression, "Cloud hopping"? I have seen this used in connection with soaring and gliding contests and am curious to know what it means.*

Answer:—IN cloud hopping, advantage is taken of the thermal currents under the clouds. The difference in temperature under a cloud, and open spaces in the clouds, sets up vertical currents in the air that can be employed to sustain the glider in flight. Thus, taking the advantage of an uprising current at one point, and avoiding a vertically descending air column at another, flight can be maintained indefinitely by hopping from the shadow of one cloud to the shadow of another.

(*Continued on page* 118)



A point on a propeller blade describes a curve known as a "helix" when the ship is in flight. The blades travel on this helix as shown.

True Tales From the Hangar And Field

"WELL," said Jimmy, "one of my most exciting experiences happened when I was delivering, or rather attempting to deliver, a ship from the factory to a small town on the eastern seaboard. My employer was a wealthy sportsman who had taken a liking to a new sportplane that had just been brought out, and he sent me to the factory to ferry it back to the home airport. He was anxious to receive this ship, as he intended to enter it in a race at an airport opening on the following day.

"I left the factory early in the morning and stopped in Columbus, Ohio, for fuel. Some two hours after leaving Columbus I ran into a few snow flakes, but it looked like it would not amount to much, although I was approaching the mountain range. The weather began getting heavier and heavier and I grew apprehensive about trying to cross the range under such condition, but I knew that if I failed to deliver the plane that evening, my employer would not be able to enter it in the races the following day.

"It began to look brighter ahead, and I decided to try to make it through. That was where I made my mistake, for instead of getting better it got heavier. When I tried to turn back I found that it was just as heavy behind me. The storm got so thick that I could just see the 'N' struts near the wing tips.

"It was the first blind flying I had ever done and it kept me mighty busy. I found that I could not keep my compass from swinging, no matter how much I tried. I knew that the mountain peaks were very high in that vicinity and this gave me something else to think about. I climbed for altitude until my gasoline gave out and switched on the reserve supply. That lasted for fifteen minutes and, when the motor coughed, I nosed down a little bit, climbed upon the edge of the cockpit and bailed out.

"I pulled the ring and the chute opened immediately. In a little bit I heard the ship hit the ground, and in about a minute, I landed on the side of a mountain in about six inches of snow. The wind was blowing so hard that the chute dragged me thirty yards before I could get loose from it. I gathered up the chute, and walked down the mountain until I came to a little creek. I followed the creek until I came to the camp of a party of hunters.

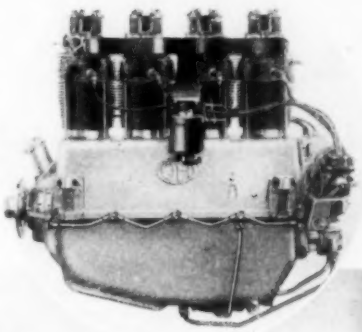
"They thawed me out and when the storm was over on the following morning, took me into town where I telephoned my employer. To show you that he is the finest boss in the world, I'll quote his reply. He said, 'Well, I guess that Bob will have to fly the old ship in the race this afternoon. You go back and accept delivery of another ship, as I want to hop down to Florida

(*Continued on page* 132)

The Gypsy Moth and Puss Moth Planes

ONE of the best known light machines in England is the DeHaviland Gypsy Moth, and our readers have heard it mentioned from time to time in Lady Heath's column. There are also a number of Gypsy Moths owned in the United States, and they have given a good account of themselves.

It is an O. C. ship driven by a 4 cylinder "in-line" vertical air-cooled engine. The construction is of wood throughout, the fuselage being a three-ply veneer built up on spruce longerons and web members. This is one of the few light biplanes provided with folding wings, and they permit the Moth to pass through a ten foot door opening.



The "Gypsy Moth" is an open type biplane. IN CIRCLE. The engine of the "Gypsy Moth" is a four cylinder "in-line" type.

The Puss-Moth, also built by the DeHaviland Aircraft Company, is a closed job but of the same general type. It has a high speed of 128 miles per hour, a stalling speed of 42 miles per hour and a cruising speed of 100 to 110 miles per hour. We are printing the photographs of the two DeHaviland Moth planes in response to a demand from many of our readers.

The "Puss Moth" Dehaviland in a cabin type monoplane of the same general design. Note the hood.

Planes Dispatched By Light

NIGHT dispatching of planes at United Airport, Los Angeles, is done with an ingenious device consisting of two lamps attached to cords long enough to reach the end of any of the five runways. One lamp is green, signalling "take-off," and the other is red, signalling "wait." Increased night flying activities made some such dispatching device necessary.

A Survey of Air Traffic

A GRAPHIC illustration of the manner in which the regular traveling public has turned to air transportation. was presented today in a statement of Century Air Lines officials that 57.2 per cent of traffic over those lines was composed of men and women who travel regularly. This survey also showed that 78 per cent of the regular traffic was composed of business men.

Russian Reefing Wing Ship Completed

A rather striking and unusual design is this Makhonine retractible wing monoplane. Note the Sliding wing tips.

IN OUR last issue, we showed a detail of an interesting sliding wing tip by which the area of the wing can be varied in flight. In this issue we have the good fortune to show a photograph of the entire monoplane, a picture that indicates a great number of interesting constructional details in addition to the retractible wing. This ship, the invention of Comrade Ivan Makhonine, has attracted the attention of the French government.

The reduction of wing area to obtain higher speeds, and an increase in area to reduce the speed of the ship, is called "wing reefing." This is not altogether a new idea although it is carried out by a unique method in the ship shown here. By drawing in the wing tip by a special mechanism, the area is correspondingly reduced, while the loading in pounds per square foot is obviously increased. This allows higher speeds at the most efficient angle of attack.

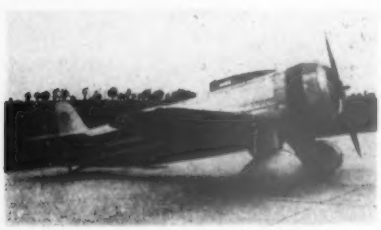
Thus, we can attain high flying speeds with the wing tips withdrawn and still maintain the most effective wing angle. If we wish to land at low speed, the wing tips are extended to the utmost, the unit loading is decreased, and therefore the speed is also decreased—all at the same angle. And still another point. The nearly constant angle of the wing means that the center of pressure will not move, and that the stability of the ship will be increased by just that much. There is food for thought here—well worthy of general attention.

As will be seen, a great deal of care has been taken in the adaption of streamlining to the ship. The fuselage, and particularly the nose of the fuselage, is well worked out, and the pants over the landing gear are some pants. Note also, the wide wheel tread and the generally clean lines of the ship.

Winner of The Michelin Trophy Race

THE Michelin Cup, this year, has been won by M. Haegelen, the chief pilot of the Society Generale Aeronautique.

The ship was the Lorraine Hanriot LH 41 monoplane, specially built for the 1930 trophy, and modified for the 1931 cup. On the 2,631 Kilometers with



The Lorraine-Henriot monoplane.

a landing speed of 226 Kilometers, 450 k.p.h. was realized on an average.

The Lorraine Hanriot monoplane was powered with the Lorraine 240 H. P. radial air-cooled engine with a Naca capot. This plane will be—perhaps—utilized by the French army as a standard training plane for acrobaties—chiefly in the Pursuit groups.

American Airplane Explores Brazil

THE airplane, penetrating the mysterious jungle region between the Xingu and Tapajos rivers in Brazil, is being used for the first time to explore a civilization said to be older than the Egyptians. Commander George M. Dyott, British explorer, is now flying southward from the Amazon into a strange and savage country whence no other white explorer has ever returned alive. For the past four hundred years one expedition after another has been cut down by the savage Indians, who guard the gates to this land of ancient temples and vast treasures.

This young Englishman has established a base at Alexandria, at the head of navigation on the Amazon. He will fly in a large plane of American manufacture, and will be able to reach his objective in about five hours. It formerly took months of weary marching thru the jungles. Commander Dyott's plane has a load capacity of 3,500 pounds, and is equipped with the very latest of aerial photographic equipment. It also carries a formidable array of machine guns and automatic rifles.

Challenges The Autogiro

THE discussion is now on: The Autogiro vs. Conventional Aircraft.

Everyone has heard the Autogiro's side of the case; how the ship can land almost vertically, how it can pull out quickly from any point in the landing run and how its safety features act in event of engine or other trouble.

But a certain manufacturer of the conventional airplane is not quite ready to concede that the Autogiro will completely supplant his machine. He says that under given specifications of power and wing loading, he can produce a plane which not only will duplicate the feats of any Autogiro of equal specifications, but which will give the added safety factor of a longer and more elastic gliding range in cases of dead-stick landings.

Maj. Thomas Lanphier, president of the Bird Aircraft Company, challenged the Autogiro to a contest under terms which were judged fair and equal for both contestants. The challenge was not accepted by the Autogiro manufacturer.

He offered to allow either expert or novice pilots to fly both machines and challenged the claims of Autogiro enthusiasts that the instruction period on that type of craft was shorter than on conventional airplanes. He also offered to duplicate any landing feat performed by an Autogiro of equal power and load capacity with his own biplane.

Maj. Lanphier says that an emergency glide to a landing after motor failure can be made over a much wider area with airplanes. With the Autogiro, the craft comes almost straight down, leaving little choice to the pilot where the machine will come to rest. In addition, he points out, that far greater loads can be carried with equal horsepower in the airplane, giving that type greater factors of economy and utility.

A contest between an Autogiro and an airplane was held at a New York City airport, but the wing and power loading ratios of the two craft were so different that no accurate comparison could be made.

The biplane, which Maj. Lanphier proposed to use in the contest with the Autogiro, is known for its wide speed range and slow landing. It was favored to win the recent Guggenheim Safe Aircraft contest, and only failed to win a place in the finals when its top speed fell four miles per hour below the standard of 114 m.p.h.

Lindbergh Hires Japanese Pilot

EVIDENTLY recalling the troubles of Pangborn and Herndon in Japan, Col. and Mrs. Charles A. Lindbergh took no chances when they flew from Tokyo to Osaka, the largest city in Western Japan. They arranged to have a Japanese navigator pilot them on the trip so they would not break Japanese regulations governing flying over fortified areas.

XUM

Practical Lessons in Flying

by JOHN B. RATHBUN

After an experience with a thunderstorm, Ed and Bob take up the study of meteorology in earnest.

BOB, the flight student, and Ed. Keith his instructor, had met outside the hangar as usual before taking their daily dozen. However, some dirty looking black storm clouds had blown up suddenly, and they had decided to postpone their flying exercises until the weather had cleared up.

The wind came in gusts, the dust flew up in clouds, and the whole landscape had taken on a forbidding look. However, away to the west, they could already see bright patches in the sky, so that it was likely that they could resume their work in a short time—always providing that the field didn't get soft and mushy from the rain.

"This is certainly a heck of a note," exclaimed Bob as he looked at the sky. "I was all pep and enthusiasm when I drove the old jillopy out here this morning, and now it looks as if we were in for a good sousing."

"Well, don't commit suicide over that little thing," said Ed., the instructor. "If you'd remember a little about what you studied in that meteorology book of yours at the ground school, you wouldn't be lamenting. This thing will blow over quickly, for you remember the old saying, 'that if there is a patch of blue sky large enough to make a pair of britches, the rain will go by in half an hour'."

Bob shook his head. His only reply was a subdued "Baloney." He had really hoped that Ed. would have taken off in the face of the storm, just to give him a little rough weather flying experience, but Ed. stood there without a sign, kicking up the dust absentmindedly.

"Well," said Ed., "I see that these glider guys are going us one better and are doing some of their gliding on line-squall fronts and in the front of thunderstorms. They can have that stuff if they want it, but it's not for me. I read of a bird the other day who stood around waiting for a thunderstorm to come along so he could take a nice long ride in front of it without burning any gas. He must be 100 per cent Scotch, believe me."

"Anyhow, they don't get cooped up, just on account of a little wind," said Bob, disdainfully. "I'd just like to try some of this rough weather stuff just to see how it feels. I'll sign any sort of a release that you will give me to sign, if it's a damage suit that you are afraid of."

This remark, and the peevish tone that it was spoken in, acted on Ed. like a charge of dynamite. It was the first time that Bob had ever seen Ed. thoroughly angry and sore, and Bob

A wind-gust recorder used by weather bureaus in determining the frequency and intensity of wind gusts. This is highly important as an aid to safe flying.

wished from the bottom of his heart that he had left this wise crack unsaid.

"All right—all right," shrieked Ed. "If you want to be a darn fool and take chances when it is not necessary, come ahead. Damages or no damages, crash or no crash, I'm going to make you eat that. Now come right along, and I'll give you all the rough weather sailing that you're looking for. If you think that you have me buffaloed, you're a long way off the trail.

"Now just come here into the doorway and look down southeast. Do you see that rolling, tumbling patch of black cloud? Well, that is a flying scud that is being tossed about by a bunch of mighty mean wind. You'll feel it in a minute and when it hits you, you will hardly be able to stand up against the blast on the good solid ground—let alone in a ship. The first thing that you will feel will be a good rough stream of ice cold air, then a short calm and then a stiff wind in the opposite direction. It isn't so much the force of the wind. It is the sudden reversal of direction and the rolling mix-up of currents that is accompanying the scud, together with the bunch of hailstones that it is carrying."

Before Ed. had a chance to drag Bob through the door to the ship, as he had really intended doing, the squall hit them and then came a deluge of rain that nearly blinded the two. It wasn't long before the hail came rattling down, and it came so hard that it would have undoubtedly riddled the fabric on the wings and splintered the propeller had they wheeled the ship out into the open.

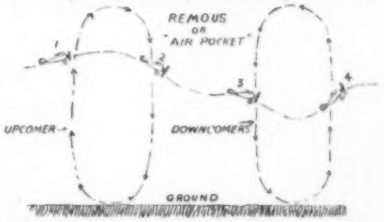
"Whee—whoosh," exclaimed Bob, as he beat it back through the hangar door for shelter. "Say, Ed.—forget it. I guess I was so ambitious to get going that I insulted you by doubting your courage. I didn't mean it, honest. Be a good guy and smile once more—it's all my fault."

Ed. was good and sore, but the scared look in Bob's face calmed him down, and finally the smile came—as per schedule. "Well, if that soaking you just got don't cure your affections for squalls and thunderstorms, nothing else will. You go home after you're through here and look at that pretty picture book with all the nice clouds in it. Then study them. If you never got a good busting in your life before you sure would get it out there. Listen."

"WH-E-E-E," sang the wind, and the cold wind nearly froze Bob where he stood. The terrific rattle of the rain, and the hailstones on the roof of the hangar, prevented them from hearing each other further. Then came a bright steel blue flash, and the crash of a nearby lightning stroke. Bob shuddered when he listened to the uproar, and wondered what would have become of him if he had not taken Ed.'s advice. More flashes, more crashing thunder, and then the storm blew away almost as fast as it had descended upon them. It was only a little cloud patch—but it was a hot baby whilst it was with them, and most certainly would have wrecked any ship in its path.

"Now, Mister Thunder-Bird," grinned Ed. "I'll make a little sketch that will show the mechanism of that last snorter that went by. It works on a well known principle, just like a gasoline engine in one respect, because it operates entirely by heat energy. It starts off very quietly and innocently, but it is not long until it develops into a rip-snorter—if the conditions continue favorable.

"In the first place," said Ed., "We have a dazzling hot sun and a moist or humid atmosphere. The sun on striking the earth, heats it, and be-



Showing the progress of an airplane passing through vertical currents.

fore long, there is a blanket of very warm air spread over the surface of the ground. This, of course, is on a calm day with no wind—for even a slight breeze would break up the blanket of warm air. (See Fig. 1.)

"Now, the air blanket gets warmer and warmer, next to the hot earth, until finally it becomes so hot and light that it tries to break through the colder air strata above it. Finally, at some starting point, at a fence post, a small hillock or other projection above the general surface of the earth, the warm air breaks through and follows up vertically in a 'riser.' Once this circulation gets started, it increases faster and faster, so that much of the moist surface air is projected up thousands of feet above the earth where it is cooled off by the low temperatures at the higher altitude.

"When the air is chilled in this way," continued Ed., "the moisture in it is condensed into small drops, and this mist then forms a white irregular mass of vapor and mist that we call a cloud. The cold air now descends in a stream, called a 'downcomer,' so that a continuous circulation of air is set up that acts much like a moisture conveyor. If not disturbed by wind, this will continue until we get a large mass of white cloud—like those you see on a hot summer day—and then the stage is all set for something."

"Oh," exclaimed Bob, "so those upcoming and down moving currents of air account for the 'bumps' that we get on a good hot, moist day. I suppose, that when we hit an upcomer, the ship jumps up, and that she drops out from under us when we hit a downcomer."

"Just so," said Ed. "On a hot, calm day, the air is very bumpy just for this reason, but when a good stiff breeze comes along, it breaks up the circulation and tends to smooth out the atmospheric conditions. To produce a squall or a thunderstorm, we must therefore have three things occurring at the same time: Heat, moisture and calm air. If it were not for the moisture carried up, and its subsequent condensation, we would have no lightning.

"Well," explained the pilot, "this thing keeps on until we have a big cumulus cloud with electrified moisture particles. You see, the moisture carries electrical charges with it into the clouds which are greatly amplified when condensation takes place. For example, a cubic inch of water vapor condenses into a water droplet having about 1/2000 the size of the vapor, and when this shrinkage takes place, the intensity of the electrical charge is increased proportionately."

"Say, Ed.," asked Bob, "what are cumulus clouds? Are they the white or black rain clouds? I never can remember which is which unless I have my book with me."

"Cumulus clouds," answered Ed., "are the brilliant white masses of clouds that look like bunches of white wool. They float along at a considerable altitude, and the whiteness is due to the fact that they are composed largely of very small ice particles instead of water. At that altitude, the temperature is usually below the temperature of freezing water—hence the ice or hail.

"Anyhow, we have a big cloud that is highly electrified, but it can do nothing in the way of lightning until it is accompanied by a larger area of rain clouds. However, the cold cumulus clouds soon condense a lot of water vapor at the altitudes below them, and then we see the black underlining to the cumulus clouds that begins to look like rain.

Clouds composed of water vapor or water drops are gray or black. Accompanying the white cumulus clouds is the uniform layer of dark gray clouds, called 'stratus' clouds, while below them are the sooty black 'nimbus' clouds that are characteristic of the low lying clouds in a thunderstorm.

"As the stratus and nimbus clouds continue to occupy more area, the electrical potentials rise higher and higher, until finally the voltage breaks down the resistance of the air and a lightning stroke takes place between the cloud and the earth." (See Fig. 2.)

Bob thought a moment, and then asked, "What about the high winds that come with such storm clouds, and how are these winds started locally when there were no winds before?"

"There are no general surface winds," said Ed. "The wind that you feel is mostly a strictly local wind coming from the vertical currents. (See A and B in Fig. 2.) The first draft that makes itself known is the upcomer (A) that blows the dust and papers about, just before the storm strikes. This is followed by the ice cold downcomer (B) that is typical of a summer thunderstorm."

"ABOVE the clouds is the brilliant cumulus 'thunderhead' shining white like a big cream puff. Below this is the slate gray stratus cloud, and next to the earth is a tumbling jet black billowing mass of clouds known as the 'nimbus.' Caught in between the upcomer and downcomer is a mass of clouds that are rapidly rotated by the vertical currents. This is the 'flying scud' of which I have already spoken. Just to the rear of the scud we will find the first and most violent of the lightning discharges. However, after the clouds are fully developed, strong electrical charges will be found in the following nimbus and stratus clouds.

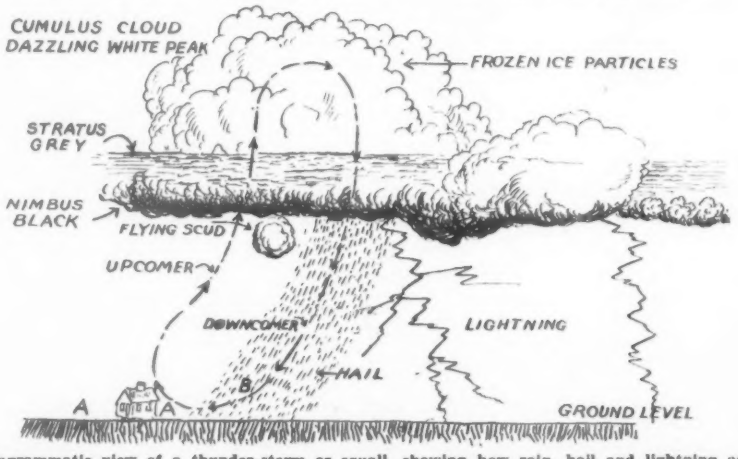
"Hail will generally fall under the thunderhead because this cloud is made up of frozen water particles. If these particles are blown apart by a heavy wind, they will melt and fall as rain. However, if the air is fairly still, and if the temperature is also high, then thousands of these particles will combine and form lumps of ice that we know as 'hail.'

"As you can see, Bob, this violent disturbance is best avoided. Particularly, we should avoid the thunderhead because of the hail, sharp ice particles and the possibility of being struck by a bolt from this highly charged mass. While gliders have soared in front of such storms for many miles, supported by the strong upcomer (A), yet this is not safe owing to the possibility of such storms breaking up and reversing the direction of the air currents. If the glider or airplane should get back into the downcomer (B), then the ship would be dashed to earth."

Bob looked over the diagrams, and then remarked, "Well, I can see what you were all fussed up about when I got pouty before the storm. It certainly is not so very healthy to get tangled up in the machinery of a thunderstorm with the violent downcomers and whirling masses of clouds. Of course, I had the intention of riding on a rising thunderstorm front like the fellows that I have read about—but now I don't think the game is worth the candle."

"No—you said it," replied Ed. "Now, we will see what effect such vertical

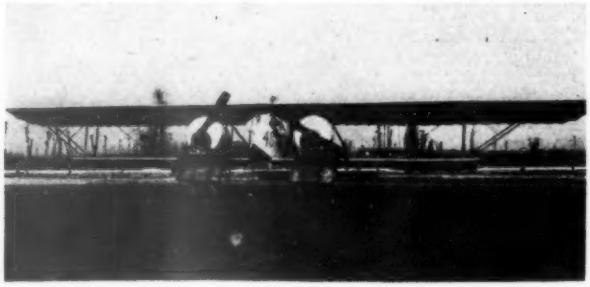
(*Continued on page* 126)



Diagrammatic view of a thunder-storm or squall, showing how rain, hail and lightning are developed from uprising currents of moist warm air. Note that the wind is horizontal for only a short distance.

Famous Planes of the World War

Five More Unusual Photographs for Your Album



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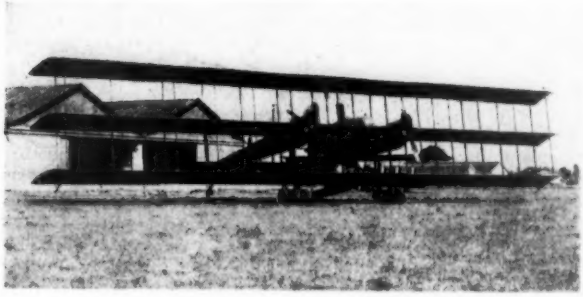
Left.—A twin-engined French Caudron biplane bomber that saw considerable service. The trailing edges of the wings are flexible and have the characteristic looped wave effect. This cowling is a long way from being streamlined. What do you say?

* * *

Right.—The celebrated Italian Caproni triplane bomber that arrived at the end of the war. It was not particularly efficient although it had a high available lift. Many of these ships were equipped with Liberty engines after the war.



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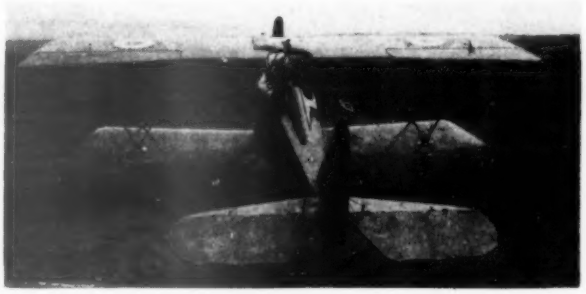
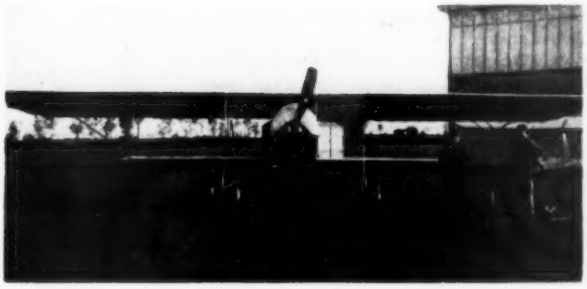


Left.—A rear view of the Italian "Ansaldo" biplane. This ship had a beautifully formed fuselage, of graceful appearance, while the interplane bracing was of the "zig-zag" or "Warren" type trussing. This was really an advanced design that came rather late.

* * *

Right.—A single engined French Caudron biplane of rather an early period. This saw extensive use at one time as a reconnaisance or observation plane, and was powered with a rotary type engine such as the Gnome or LaRhone. Note the wide-spread landing gear.



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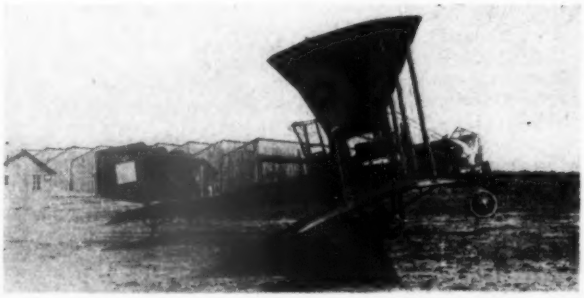


Left.—And what have we here? Is this a Farman, a Savoia, or simply an early Italian Caproni? Note the triple rudders, the forward gun turret, and the peculiar quirk in the bottom of the fuselage that points to an origin in the Caproni shops. Well, what is it?

* * *

The Round Robin Club

A correspondence plan for POPULAR AVIATION readers.

YES, business is good in Round Robin circles. All of a sudden, the members are beginning to remember that they are members, and the letters come rolling in quite regularly after lying dormant for some time. We are forming more clubs, as you will see as you read farther, and we trust that the members of the new clubs will prove loyal to the cause and dedicate their best efforts to the promotion of aviation.

We have had at least five inquiries by prospective members regarding the use of a typewriter. No fellows (and one girl), it is not necessary to use a typewriter for Round Robin correspondence. Just write plainly enough, so that your letter can be deciphered by the other members and your letter will be acceptable—believe me.

And please don't forget that POPULAR AVIATION is member No. 1 of every club that has been formed. Forgetting that the last member, No. 11, must send the packet to us has tied up several clubs, at least temporarily, until we found where the trouble lay. As soon as we get the letters from the last member, we will start them circulating again, enclosing a letter of our own.

And what do you think? We have an author or rather authoress, among the members of the Round Robins. We received her article, which is so good, by the way, that we can't figure out whether the story is really true or not. Anyhow, you will soon be able to judge for yourselves when you see it in these pages. Our thanks and felicitations to Dorothy Dean.

So far, many of the letters have been more or less of a general or personal nature, with a few expereinces now and then. We had rather hoped that somebody would start a hot debate upon some subject. So far, the debates or arguments have not started except for that old-time favorite, the wood ship versus the steel framed ship. As we mentioned before, it is strange how nearly all members of argumentative disposition, fell on this subject at the same time. Perhaps, though, as the nights grow colder the ideas will grow hotter—or words to that effect.

We are also looking forward to the time when some of the bunch will follow Dorothy Dean's lead and send us some articles. There is only one thing that we beg of you to remember, when submitting such articles, and that is, leave out the poetry and the crashes. Outside of that you have the whole wide world to roam in. If you can manage to send a photograph with it, this will greatly increase your chances of acceptance.

For the benefit of the newcomers, who have not been following the Round Robin's progress, we will give a short explanation of the club and the way that it works. First, the purpose of the club is to place those of our readers into communication with each other who wish to discuss aviation. By this means you can enjoy your fad together. If the system is carried out to the fullest extent, you get a maximum of replies with a minimum of writing—and that's something worth while.

To join the club, send your name, address and age to POPULAR AVIATION, 608 S. Dearborn St., Chicago, Ill. Your age is of great assistance to us in placing you in a congenial group.

After we have received your letter, and completed the organization of your club, you will be assigned to a group and will be given a number. You will also be provided with a list of the names and addresses of the other members to whom you are to write. We will write the first letter to member No. 2, and he will in turn write a letter of his own to No. 3. He will enclose our letter with his, and send the package to member No. 3. In this way, all of the letters are seen progressively by all of the members. Finally, member No. 11 sends us his letter and the other letters to us, completing the chain. We will then start the series over again.

In the following list are the new clubs recently formed and their membership:

CLUB NO. 7

(2) Charles Stift, 431 48th St., Brooklyn, N. Y. (3) Edgar E. Paschal, Route 2, Frisco, Tex. (4) Robert J. Allen, 230 Chemung St., Corning, N. Y. (5) Herbert Rook, 315 W. 4th St., Julesburg, Colo. (6) Wm. Eymann, 609 Riley St., Atchison, Kas. (7) Fred E. Mikowsky, Jr., Box 685, East Pittsburgh, Pa. (8) Leonard Gelardi, 16 Pine St., New Brighton, Staten Island, N. Y. (9) Lloyd La Plante, 3324 Irving Ave., Minneapolis, Minn. (10) Verle Stiverson, Broughton, Kas. (11) Bud Riegert, Jr., 2009 Cherokee St., St. Louis, Mo.

CLUB NO. 8

(2) William Ishii, Rt. 1, Box 173, Sacramento, Cal. (3) Hector G. Goldsmith, care Safe Deposit Co., 747 S. Hill St., Los Angeles, Cal. (4) F. W. Keil, 1034 S. Adams St., Freeport, Ill. (5) Vernon Logan, Iona, Ill. (6) Howard L. Doolittle, 126 Eden Ave., Southington, Conn. (7) Elmer Olson, Gascoyne, N. D. (8) Suzanne Humphreys, Far Hill, N. J. (9) Clarence R. Hoffman, 302 N. Nice St., Frackville, Pa. (10) Edward Winfield, Y. M. C. A., Omaha, Neb. (11) Wm. Daniel, Hugo, Colo.

The first member of each group will hear from us shortly, thus setting both clubs into action. This letter will give further details, and instructions, so that you will not go astray. A number of the first clubs have sent bunches of letters around the circle several times.

Another Ornithopter

A LOS ANGELES airman is preparing for a one-man endurance flight to be made during the Christmas holidays. He will use an automatic-flying airplane lately invented and tested. The new plane will be a cabin high-winged monoplane equipped with free moving wings, which, combined with the action of the automatic tail stabilizer and rudder, will keep it on even keel without the aid of the pilot.

The wings smooth out the air "bumps" and tip or correctly bank the plane to the turn. They also change the plane's body separately or together, depending on the air pressure encountered in flight. It has been experimentally proved that he can set the ship's elevator for any desired height and maintain that altitude without touching it.

It is planned to get 6,000 feet altitude or more at night to clear any commercial ships, set the rudder so that it will make a twenty-mile circle over the city and then go to bed.

A Streamline Engine

An English Ultra-Fighting Plane.

ONE of the new ultra-fighting planes being built in England for the Belgian government is shown in the illustration. The engine of the new biplane is streamlined into the fuselage and both the engine and the ship itself are designed for an exceptionally rapid rate of climb and high horizontal speed—two essentials of all fighting planes.

Field Jokers

THE field manager for the Eastern Air Transport System at the Municipal Airport, Macon, Ga., recently received authority to employ a porter at a certain salary. Employment slips came back to the Brooklyn headquarters of the company showing that two porters had been hired and the authorized salary split between them. Whereupon, F. W. Whitmore, assistant secretary and treasurer, sent a memo by airmail asking: "How come?"

Back came a memo in reply which stated:

"When the one applicant was accepted for the job, he said he had a friend who was very interested in airplanes. He wanted us to hire his friend also and split the salary in half, so this was done."

The K-2 Kellett Autogiro

THE Kellett K-2, 165 horsepower Autogiro, has made its appearance, and differs considerably from the well known Pitcairn Autogiro. The Kellett K-2 is not designed for speed, its maximum being 100 miles per hour, but it is especially designed with safety in mind, the idea being that anyone who can drive an automobile can easily be taught to drive one of these machines.

One of the most striking things about this new Autogiro is the cockpit arrangement, where the driver and passenger sit beside each other in a most comfortable manner. And there are dual controls arranged so that the passenger can readily learn to drive the Autogiro. It is a particularly safe ship to learn flying, for it cannot stall and it cannot be spun in landing.

The cockpit is as wide as the front seat of the average automobile, and the side-by-side arrangement gives a more comfortable and secure feeling to the student. The landing gear differs considerably from the other Autogiros in that the wheels are set twelve feet apart and are equipped with shock absorbers. Even the tail wheel is so

A Kellett K-2 Autogiro in flight. Notice the large diameter pylon and the wide spread wheels.

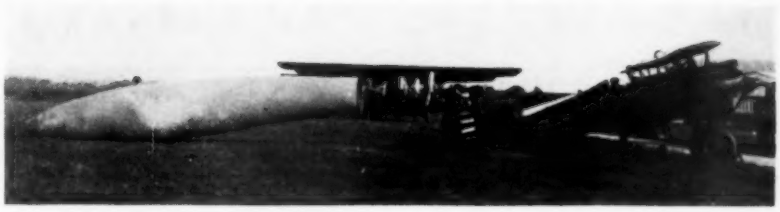
equipped so that landings on lawns and golf courses do not harm the turf. There are no wires used as stays. The rotor pylon is of novel construction, being large and sturdy and looks much like a "stove pipe."

Farmer Finds Use For Plane

THE airplane has its place on the farm, according to Howard A. Crosby, Hinsdale, N. Y., dairyman, who found four lost cows by means of an airplane recently.

After a hot day on the farm, Mr. Crosby had neither the desire nor the ambition to chase over the hills and through fields after straying cows. So he went to the Hinsdale airport, engaged the services of Pilot Leo A. Demsky and took off in search of his wandering cattle. Within a few minutes, after a cruise over the valley about Hinsdale, the plane passed beyond a hill and into the next valley to spot the cows almost instantly. With the location established, Mr. Crosby returned to his farm and within a short time had the cows back on their own range.

Airplane Target Used at Army Fields



The airplane target, at the left, looks like an over-grown wind-sock. Comparing it with the plane, it would seem that this target would be easier to hit than the ship.

HERE we have an army plane making ready to go aloft with a target for aerial gunners. The target is the bag behind the plane at the left. This practice was staged at Aberdeen, Maryland, for the benefit of 6000 members of the Army Ordinance Association. The target is about as long as the plane and is dragged along through the air by a plane, but separated from it by a cable a mile or more in length.

Firing at these targets has been instrumental in developing the anti-aircraft division to its present high state of efficiency. At Wilbur Wright Field, so it is claimed, the anti-aircraft gunners are averaging 80 per cent hits with the targets at an elevation of 10,000 feet.

Heath Plane Lands on Roof

PROVING for the first time the practicability of roof landing fields in the heart of a city, a Heath Parasol was brought down without difficulty on a building in Grand Rapids, Mich.

The plane was piloted by C. Duke Muller and the landing was made on the roof of the American Seating Company, an area 80 by 390 feet. The experiment was arranged by Walter A. Clinnin, President of the Heath Corporation and Paramount Sound News.

The Heath Parasol has a wingspread of but 25 feet. It is powered with a Continental 8-40 motor and won a National Air Race contest in its class.

Muller delivered a package containing business papers to Harry M. Taliaferre, President of the Roofing Company. The plane circled the roof of the four story building once and dropped lightly down. It came to a halt a few feet from the throng of spectators gathered at one end. The take-off from the structure was made just as if the roof had been a landing field.

Mr. Taliaferre, though he does not plan any business service with roof landings at present, said that he believes the experimental landing proves conclusively that such landing fields will be the business airports of the future.

Mouse and Canary Are Rocketeers

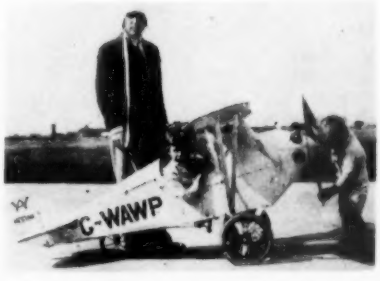
A MOUSE and a canary had a ride through the atmosphere at the astounding rate of more than a mile and a half a second in the Lybian desert, Africa. The experiment was conducted with a rocket by Dr. D. O. Lyon, American physicist and "rocketeer," to determine the effect of such great speed upon vertebrates. When the rocket came down, the mouse and canary were none the worse for their ride. Dr. Lyons is planning to shoot a giant rocket next January with a human being aboard.

A Mechanical Rooster

AN AIRPLANE that presents the appearance of a flying rooster is the ingenious invention of Angel Mateo, of Santiago, Santo Domingo. It depends mainly upon a propeller for its going power, but it also flaps its wings. The propeller is mounted upon the beak of the bird, and the motor for driving the propeller is housed inside the rooster's neck. Wheels mounted on the legs provide the landing gear.

The extensible wings are each in two sections and are hollow, the outer section being spread outwardly by expansion springs. The means for raising and lowering the wings is provided by rods projecting from the body of the rooster. These rods are operated by gears and sprocket chains driven by the engine, thus producing the realistic flapping effect.

Cut Down To Boy's Size



This is about as small as we have seen!

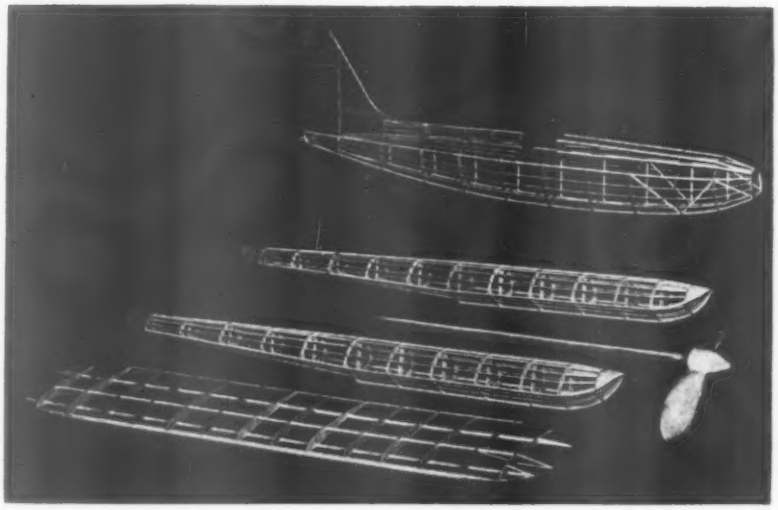
J. A. MOLLISON, the Scottish aviator, who recently set a new record for the Australia to London flight, when he made the trip in less than nine days, believes in early flying instruction to the youth of England. Here he is initiating Mark and Desmond Norman, sons of Nigel Norman, into the secrets of a moth plane at Heston Aerodrome, near London.

MODEL DEPARTMENT

HOW to Build the Super-Marine Seaplane

by

JOSEPH S. OTT



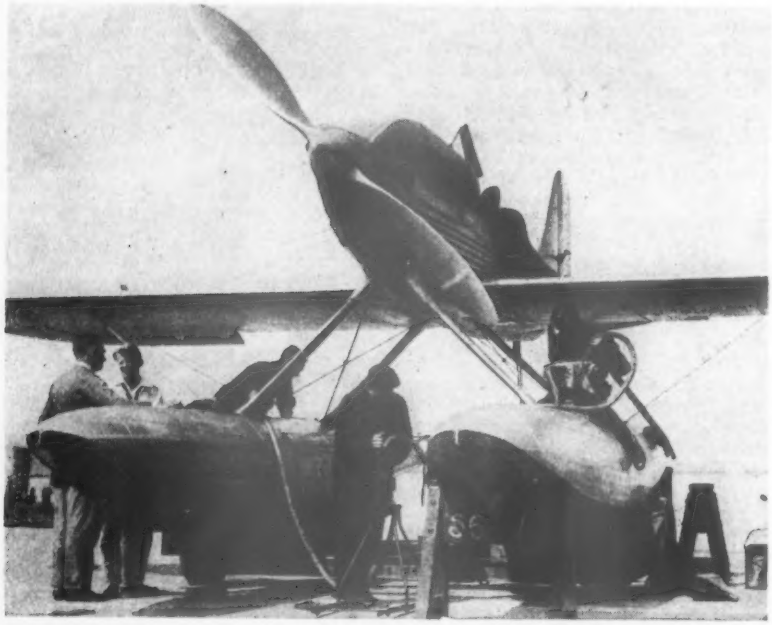
THIS month we are presenting a model of the Super-Marine, Rolls-Royce motored Schneider Cup Winner. We have prepared an Ansaldo, which is an Italian World War plane, but this was held up in preference to the one given. Because of the limited time allowed, we were not able to put in a picture of the completed model, but are showing a view of the full size machine, which, together with views in another part of this issue, should be sufficient.

Because of the large size of the floats and the body, there is not sufficient room on the magazine page to give a 6″ scale of the three full views. It will be remembered that the 6″ scale was standardized, for that size model could be made simply by multiplying this size of the drawing. However, the top and the side view are fully illustrated, and this should be sufficient from which to build the model.

One addition may be noted, and that is, approximately 5″ has been added to the length of the motor stick. The chord on this model is very deep—6″ for a 30″ wing span.

ABBREVIATED BUILDING INSTRUCTIONS

1. Floats.
2. Wing.
3. Body.
4. Rudder.
5. Stabilizer.
6. Assembly of the floats to the body.
7. Assembly of wing to the body.
8. Bracing the wing—(heavy thread).
9. Propeller.
10. Motor stick.
11. Motor clip—(fittings).
12. Covering floats.
13. Covering body.
14. Covering wing panels.
15. Doping—(floats).
16. Spraying wing and body—(water).
17. Decorating.



Full size Super-Marine seaplane on dock, just before entering race.

MATERIALS

1. Landing gear — 3/32″x¼″ — hard Balsa.
2. Body—10 pieces—3/32″x3/32″x30″—Balsa.
3. Wheels—for 24″ model use, wheels 1⅞″ diameter; for 30″ model use, wheels 2¼″ diameter. Either celluloid or built up Balsa. Floats—3/32″ square Balsa; 1/16″x⅛″—fairing strips.
4. Tail — 2 pieces—1/16″x¼″—hard Balsa.
5. Fittings, piano wire — diameter .029.
6. Struts—2 pieces—1/16″x¼″x15″—Bamboo. Sheet Balsa—1/32″x2½″ for sections. Also, 1/16″x2½″ for sections and cowling.
7. Motor stick—3/16″x5/16″x20″ long—Pine.
8. Propeller—extra large block—1″x1¼″x11″—soft Balsa.
9. Rubber motor—20 ft.—⅛″—30 gauge.
10. Spars—4 pieces—⅛″x⅛″x30″.
11. Trailing edge—3 pieces—1/16″x¼″x30″—Balsa.
12. Entering edge—2 pieces—⅛″x⅛″—Balsa.
13. Tissue—3 pieces sheets—18″x24″—Super fine. Mino tissue for floats.
14. Rib stock—Balsa 1/32″ or 1/16″ sheet stock, approx. 2″x30″.
15. Lacquer—Black glossy for struts.
16. Cement—½ oz. unit.
17. Banana liquid—small can.
18. Lacquer—Red glossy and aluminum for propeller.
19. Washers—3 each.
20. Allied war emblems.

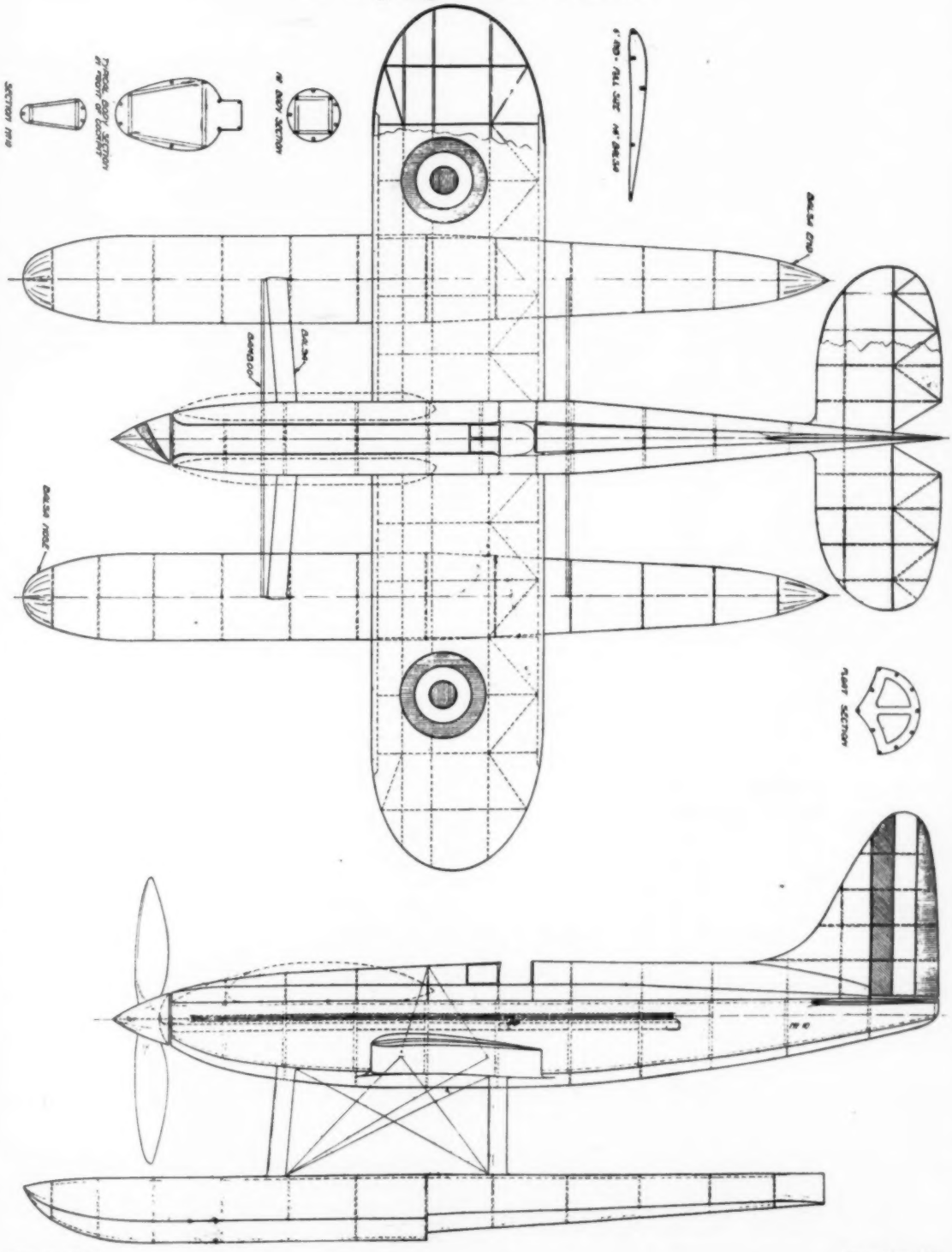
DETAILED INSTRUCTIONS

Floats—No. 1

The floats on the model are very long and narrow, having a step approximately half-way. The sections may be cut out from thin sheet Balsa 1/32″ thick. If lightened, use a heavier size

The Super-Marine Seaplane

A Flying Scale Model



—approximately 1/16". The nose of the float is a solid piece hollowed out for lightness. The tail end is also solid, hollowed out for lightness.

For those places where a large piece of Balsa is used, to make a section, always use a piece that is very light. Do not use firm or hard Balsa for this purpose.

When assembling the floats, insert the two side longitudinal members first on the extreme corners of the lower side. Then the top longitudinal member and later the fairing strips. First, build the front part to the step complete.

The sections that are all alike, from the step to the second section of the front and of the pontoon, should be cut out and then sanded together as one unit. Cut in little notches that will receive the fairing strips. The sections, after the step, are each different—with the exception of one for each float. These should be built in pairs.

Ribs—No. 2

The ribs are cut from a pattern made from aluminum or a thin piece of hard wood. Plywood, about 1/16" thick, will answer the purpose very well. All the notches should be cut into the pattern. This is done best by fitting the size to be used, for the spars at entering and trailing edges. The spars can fit in their notches, just a trifle loose, so the cement will flow all around—insuring a better grip. The amount of looseness should be very little.

Some model builders prefer to fit the spars snugly. In this case cement should be applied on both sides of the rib to prevent undue warping. To help lighten the ribs, holes may be cut into them. This is done best, one at a time, using different diameter brass tubes sharpened to a knife edge. A little pressure, and a twist backward and forward, and the piece will readily drop out.

Cut out all the ribs with a razor blade. The blade should be broken so that one end is pointed and can be used readily for cutting out the notches. All the ribs, after being cut, should be stacked into one lot and sanded evenly. At this time it will be best to cut in the spar notches. Hold the stack together first by pushing pins through from both sides.

Wing—No. 3

When the ribs are all set, the wing should be drawn out to full size on a large sheet of paper. Take a little time and make the drawing exact to the specified dimensions. Lay the drawing down on a smooth surface, preferably a drawing board. Secure some waxed tissue and lay over the wing drawing. This will prevent the wood and cement from adhering when removing after completion. Use very small pins and fasten the leading edge into its proper position.

Before this is done, the leading edge may be shaped to the required form. Some kits supply these parts ready, while in others the builder must make his own. Next, push the lower spars in place and use the edge of a "T" square to line them up evenly. Pin these in position.

Now, the ribs can be put into their correct place, cementing as you go along. The top spar is placed and cemented into position. The end of the ribs are all cut even at this time and the trailing edge placed and cemented down. Shape the trailing edge before setting into place.

Body—No. 4

Square bodies are easily and quickly made. Oval bodies are a little more difficult. But if a square body is built first and the oval sections added, it is very easy. Simply a matter of a little more time to add on the thin pieces to complete the oval. Each cross brace and upright has its added parts of 1/32" thick Balsa to complete the oval sections.

Therefore, a square body is built first, that will fit into the oval sections, and the rest is added. When laying out a full size drawing for the sides, be sure to allow enough above and below to add the oval parts. Draw the top longeron straight from the nose to the tail.

This will simplify lining up when final assembly is made. At the nose there are always a few diagonal bracings so no warping can take place and throw the nose out of line. In addition the shock at landing will be absorbed better by passing the stress uniformly throughout.

Rudder—No. 5

Draw a full size outline of the rudder and bend a piece of bamboo to conform to the desired shape. Bamboo can be bent to almost any shape by heating over a flame (candle, bunson burner or alcohol lamp). Do not burn the bamboo. Heat only so much until the fibers loosen up and bend into shape by forcing the bamboo with the thumb and forefinger.

Repeat the operation at all curves—heat and then bend to position. Immersing into water, after it is complete, will help to maintain the bent form. Hold while cooling off. Do not cool until completely bent as desired. The bent shape is made from a large piece of bamboo about 1/16"x¼".

In some cases where a bend is sharp, cut away some of the soft part of the bamboo. When bending, keep the shiny side outside of the bends. Slice down to the required size. From a large piece about ¼" wide, two and up to four parts of the same shape can be cut.

When the rudder outline is thinned it should be so the 1/32" dimension will be the thickness and the 1/16" dimension will be the depth or lengthwise way. Assemble the outline to the body.

Stabilizer—No. 6

The stabilizer is built up in a similar fashion to the rudder. Place the

(*Continued on page* 115)

Complete Material Kit, $1.00 P. P.

20 pieces ⅛ sq. x 18	7c	6 sheets Sandpaper	8c
10 pieces ⅛ sq. x 18	4c	10 ft. No. 6 Music Wire	3c
4 pieces ⅛ x 2 x 18	18c	10 ft. No. 10 Music Wire	4c
50 ft. ⅛ flat rubber	12c	6 sheets Jap Tissue	18c
50 ft. ⅛ flat rubber	25c	5 ft. ⅛" dia. Reed	3c
1 pair Celluloid Wheels, ¾" diameter	5c	2 oz. Cement	14c
6 Washers	2c	2 Thrust Bearings	3c
		Total	$1.26

2 Ft. Stinson Detroiter Kit 75c P. P.

Dope or Acetone 45c pt. Celluloid Wheels ¾ in. dia., 5c pr. 1⅜ in. 15c pair. 1¾ in. 10c pair. 1 in. 8c pair. Pants 30c pair. Dummy Motor 1½ in. dl., 18c each. 3 in. dl. 35c each. Cowling 23c ea. Double geared winders 35c ea. Aluminum tubing ⅛ O. D. 6c 1 ft. ¼ O. D. 8c 1 ft. ⅛ O. D. 10c 1 ft. Sheet Aluminum .006, 13c 1 sq. ft. .008, 15c 1 sq. ft. .013 20c 1 sq. ft. Stamps and Foreign Coin Not Accepted. No orders under 50c. Send 10c extra with orders for balsa wood, otherwise it will be cut in half for shipping. Send 3 1c stamps for Price List. Dealers and Clubs write for discounts.

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1" dia. Doughnut type, 25c pr. 1¼" dia., 30c pr.

Goodrich Tread Balloon Tired Alum. Disc Wheel—2" dia., 60c pr.

Full Balloon Rubber Tired Alum. Disc Wheels
1½" dia. 25c pr.—1¾" dia. 30c—2" dia. 40c pr.

Celluloid Untired Wheels
¾" dia. 10c pr.—1" dia. 12c pr.—1⅜" dia. 15c pr. 1¼" dia. 20c pr.—3" dia. 50c pr.

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Light Engines

(*Continued from page* 100)

NEXT, we have ignition staring us in the face, including the whole system running from the magneto up to the spark plugs. While magneto ignition is almost universally adopted at the present time, yet there is always the question of battery ignition and its possibilities. With the coming of electric lights on the wing tips and tail, the installation of radio apparatus and similar electrical equipment, it seems possible that battery ignition may eventually be adopted. Self-starters, so long delayed but so convenient with the lightplane, make another call upon the battery system.

Without going into all of the ills to which the present day standard four-stroke cycle engine is heir, we might say that it is needlessly complicated for the purpose of the lightplane. The greatest complications are the valves and valve-gear, but these can be done away with by the adoption of a simple version of the two-stroke-cycle engine. The poor old two-stroke engine has received but little attention during all these years, yet at one time it was among the most promising of the engine types. With a little development, it would be the ideal engine for the lightplane, being compact, simple and inexpensive.

IN THE first place, the two-stroke cylinder delivers exactly twice as many power strokes per revolution as the present four-stroke cylinder, hence only half as many cylinders will be required for an equal explosion balance. There are no valves on the ideal two-stroke engine—and ain't that something? In short, a two-cylinder, two-stroke engine will deliver as many impulses per revolution as the four-cylinder four-stroke engine; its length will be greatly reduced and the weight will be materially less.

By eliminating the valves, camshaft, camshaft gears, push-rods, tappets and other valve mechanisms, it is evident that the cost can be brought down materially. The fact that the fuel consumption of the present marine two-stroke engine is somewhat in excess of the four-stroke consumption need hardly be a detriment.

E. W. Roberts made many interesting developments in the two-stroke cycle engine before the war times, but for some reason the idea did not seem to take hold as it should. Some hair-brained critics started a lot of adverse propaganda about this engine, and it died shortly after birth—like many another good idea. Roberts ironed out many of the leading difficulties in the old type of two-stroke engine without introducing other complications.

The only moving parts were the pistons, crankshaft and an annular valve. There were still a few minor "bugs" remaining, but there were no unsurmountable difficulties at the time that development ceased. Properly constructed, this is an excellent type for the lightplane builder and the man who wishes to build up time at the lowest possible cost.

Before closing, I cannot dwell too long nor too carefully upon the subject of lubrication. First, we must have the proper grade of oil for the purpose, and second, the proper system for forcing the oil into the bearings.

In following articles in this series, we will enter into the description and specifications of lightplane engines now available on the market, and therefore of direct interest to the builder. Included in this series, will be various practical notes which we trust will be of service to all of our readers who have to do with lightplanes and their engines.

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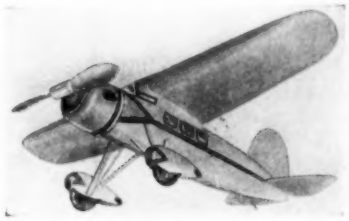

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WOMEN'S ACTIVITIES
Edited by Lady Mary Heath

Mr. and Mrs. Charles Healy Day, who are cruising leisurely round the world, are reported to have landed safely in Rangoon after a crash in the Burmese jungle.

* * *

Mrs. Amelia Earhart Putnam has unfortunately met with another accident while landing the autogiro which she has been flying for the Beech Nut Packing Co.

Lady Mary Heath.

* * *

A very fine contest for the 8,000 girl junior members of the Evening Graphic *Junior Aviation Club* has just been held. Each contestant had to describe all she knew of all the women pilots. A cup has been given to the winner and was presented at a turkey dinner.

* * *

Miss Ishbel MacDonald, daughter of the British Premier, has been flying all over England, helping her father for the coming elections.

* * *

In the early part of October the picture "Dirigible" was being shown at Freeport. The day before it was shown *Miss Eleanor Smith* flew over the town of Freeport and dropped a number of free tickets from her Lockheed. On October 5 she established a new women's speed record by flying from Camden, N. J., to Floyd Bennett Field in thirty minutes.

* * *

According to European papers, 1,300 young Italian women are now taking advantage of the fine instructions given by government pilots.

* * *

Miss Ruth Nichols, I am happy to say, has given up the idea of flying the Atlantic.

* * *

Miss Mary White, daughter of Governor White of Ohio, dedicated Port Ashland recently, flying to the port with Lieut. Frank McKee, state aeronautical director.

* * *

Miss Abbie Dill has been named assistant hostess at the Akron, Ohio, airport.

* * *

Mrs. Clark Stearns, president of the Women's National Aeronautical Association, made a brief stop at Jacksonville while flying from Miami to Cleveland.

* * *

It is announced that *Miss Amy Johnson*, of England, is going to attempt a Transatlantic flight. As she has only 700 hours of flying experience I very sincerely hope she will not undertake this very arduous flight. She has three fine records to her credit. England to Karachi in five days. England to Tokyo in 10 days and Tokyo to England in 12 days.

* * *

On October 1, a reception for the First International Commission for Motorless Flying was held by *Lady Elibank* at London, England.

* * *

Miss Jane Winstone, age 18, has just got her private pilot's license. She is therefore New Zealand's youngest lady pilot.

* * *

The first *All Woman's Flying Meeting*, held at Sywell, Northampton, England, was a great success. It was opened by *Her Grace the Duchess of Bedford.*

* * *

Miss Maud Tait, who so very nearly touched Miss Ruth Nichol's woman's speed record at Cleveland, and who flies a Gee-Bee regularly, is now the secretary and treasurer of the local branch of the National Aeronautical Association.

* * *

Miss Nell Schmied, a Viennese girl, has just received her pilot's license. She is the first of her sex to be so honored in Austria.

* * *

Miss Winifred Spooner, noted English aviatrix, won the prize for the fastest time in the Puss Moth. This was at the Tip Top Aerial Derby held during the Canadian National Air Exhibition, Toronto, Canada.

* * *

On September 29 *Miss Elinor Smith* established a new speed record of 230 miles per hour at Roosevelt Field.

* * *

Miss Ann Harding, the well known actress, sped to New York in her Bellanca machine.

* * *

Fraulein Liesel Bach has received an aviation instructor's permit in Germany. She is the first to receive it there.

* * *

Miss Charlotte Hodgkinson has just put up a new woman's solo flying record by going up alone after only two hours and twenty-seven minutes instruction.

* * *

Miss Marion Eddy, who holds the world's seaplane altitude record, has decided that women cannot make any money out of flying. Sorry, but I cannot agree with her.

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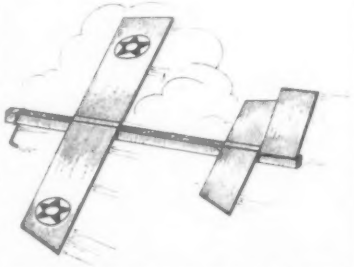
Look! This all-balsa sling-shot Glider given FREE with each Dipper or Comet Dart Set—order both sets, get 2 gliders free! How it soars, loops, glides. Fun galore! Instructive, too. Get yours now! Hurry!



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Model Seaplane

(*Continued from page* 112)

spar in place on the body and assemble the outline either from bamboo or by piecing balsa strips together and cutting to the desired shape. Some model builders prefer single covered tail sections, and this is left to his judgment. A double surfaced section makes the best appearing job.

Landing Gear Assembly—No. 7

The landing gear arrangement can be made up into a streamline form, reinforcing at the leading edge with a 1/16″ square piece of bamboo. It is best to cement the bamboo to the leading edge, as all the lumps will not dent this material. Where an upright or strut enters the body, reinforce at that point with a light piece of balsa, so the strut has a solid and rigid foundation.

The crosswise brace or axle part is also bamboo 1/32″x⅛″, held together at the point where it meets the upright strut. Cement securely and use a short length of .016″ piano wire to act as a corner brace. The wire part will prevent the two struts from pulling apart when receiving shocks on a rough landing. The point of joining the upright strut and the cross brace or axle part will be on a line with the tip of the propeller, when at rest in a flying position. This will permit the use of either floats or wheels, whichever the model builder desires.

Wing to Body Assembly—No. 8

When assembling the wing to the body, place the completed fuselage into the correct flying position. This will be necessary so the correct angle of incidence can be checked. The wing is usually cemented to the lower longeron.

The angle of incidence for a 30″ model, weighing not over 3 or 3½ oz., will be correct, having the leading edge of the wing ⅛″ higher than the trailing edge. If the rib is slightly rounded on the under side, a short distance back from the leading edge, measure the ⅛″ rise at this point.

Dihedral Angle—No. 9

Models do not have any way of controlling themselves other than by inherent stability. Dihedral is one way of holding a model on a level path. Dihedral is put in the wing by having the tips higher than at the point where it meets the body. One inch of dihedral will be sufficient. In some cases 1½″ is required. To maintain normal appearances and resemble the large model, 1″ will be sufficient.

Bracing the Wing—No. 10

The wing in most cases will be strong enough to hold the model in flight when cemented to the body, but if it receives a bump the chances are it will break or crack the wing where it is joined. Bracing becomes necessary and can be accomplished by using a fairly heavy size thread or thin strip of bamboo. If bamboo is used, push the end clear through the piece of balsa and cement on the end pushed through. This will prevent it from being pulled out.

Propeller—No. 11

Carving a propeller is not a very difficult operation, when one understands what shape the finished blade

(*Continued on page* 124)

We Like Gliding

(*Continued from page* 93)

squares a day. Yessir! I got it off fully a foot, and kept it at this dizzy altitude for not less than twenty feet.

It seems Roy had a stall complex. At any rate, he did squash in from about 10 feet. This didn't worry us much, for after all, hadn't it flown? Weren't we both glider pilots?

So we cheerfully carried the somewhat shattered remains back to the hangar, which also served as the abode for seven or eight horses and several tons of hay.

Our next flying day finished the MTG-1. After four fairly successful flights, my pal again took to the air. One wing tip dipped. While Taylor was busy warping the wings—truly a feat of strength—the glider went into a sideslip and crashed.

The fuselage broke, and so did the safety belt, so that Taylor did what you or I would have done—he went. He lit on the side of his head which perhaps accounts for the fact that he was not hurt. It was a very humorous situation, though we didn't appreciate it much at the time.

Once again we carried the remnant back, with only the far away call of a cow to cheer us up.

We lengthened the wing five feet, made a new fuselage, added ailerons and called the result "MTG-2." It was a great improvement but still very crude.

About this time, the Cleveland Institute of Aviation was sponsoring a glider contest, so we took advantage of their offer of free hangar space for several weeks prior to the contest.

During these weeks, and up to the time of the contest, Roy entertained the

(*Continued on page* 127)

Airship Walks

(*Continued from page* 88)

a process more carefully planned and executed than the launching into society of a debutante. But crew members still are at the landing stations. As they cannot be left in that position indefinitely, the captain gives another order: "Pipe-down landing stations." This is followed on normal flights by "Set the watch."

The first command permits members of the crew not assigned to special duties, to go to other portions of the ship. The second command permits the petty officers to assign crew members to definite stations where they remain for four-hour periods or watches. Then they are replaced by others who remain on duty for a like period. This continues on and on until the flight is over.

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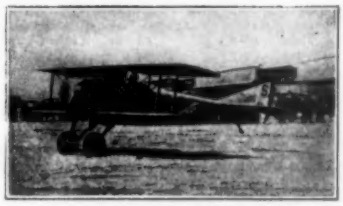

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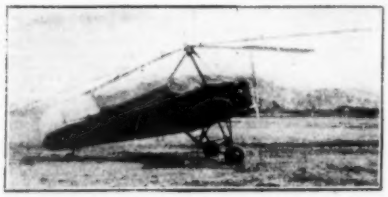

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Airy Chat

(*Continued from page 76*)

it would be an unbeatable flying proposition.

Speaking of the Peitenpol design, Bernard Peitenpol is a personal friend of mine. He has designed and built a little ship for the Model "T" motor—ond does it fly?

I suppose you are wondering who this fellow is that sends you such a letter. Well, I'm not so very old in age, but I have about 50 hours to my credit and a lot of things have happened in those hours. At first, I had an old Canuck to nurse around and I flew that ten hours. Since that time, I have had another ship and have put in a lot of work and worry and money to get the rest. I would like to hear from other lightplane fans.

Well, Lurlin, this is sure some good news. To witness a flight of this sort would certainly be well worth the time. If others of our readers are inclined toward Ford engines, we suggest that you write to Lurlin Collins about the details of this job. Probably such correspondence would lead to results of great interest and value to the rest of us.

* * *

JOE OTT, our model editor, has outdone himself in this issue, for he is presenting the full working drawings for a scale model of the Schneider Cup winner — the Super-Marine seaplane! Now this model is somewhat of a job, so it behooves the best of our modelists to get busy and build the seaplane. Because of its beautiful slender lines, and its history of speed behind it, it is well worth the effort and time spent in its construction.

* * *

ED HEATH is gone, but his memory is perpetuated by a beautiful bronze tablet now hanging on the wall of the office of POPULAR AVIATION. Ed had many friends among the readers of POPULAR AVIATION who proposed the memorial and who contributed a considerable amount of money for it. Mrs. Corrie, Heath's mother and business associate for so many years, also contributed, while POPULAR AVIATION made up the balance. The story of Ed's first flights, together with a picture of the tablet, will be found elsewhere in this issue.

* * *

THE other day I went through our files and did a little statistical work on the subject of lightplanes being built, already built or under contemplation by our readers. The result was quite interesting, and the total score stands as follows: Lightplanes already built by readers, 17. Lightplanes under construction at the present time, 12. Lightplanes under consideration, approximately 100. I intend to follow this matter up, and eventually find out just how many of these home-made ships were successful and how many were **not.**

* * *

THIS month's mail added two more letters to our dead letter department, for their writers failed to attach their names or addresses. Will *Mr Someone* who lives in Norwalk, Ohio, please send us his name and street number? Will Fred C. White please tell us where he lives?

* * *

JUST as we predicted in the November issue, the cold weather has driven a lot of our readers indoors who are now considering memberships in the Round Robin Club. In this issue, the total membership will see a great increase, for we now have a big stack of letters to sort out and divide into clubs. Now is the time for the rest of you to send in your names and addresses for admission to one of the most interesting clubs that you ever belonged to. Don't delay, for you will have many nights from now on that you can devote profitably to correspondence with the other members. You will find further details in another part of this issue.

* * *

A LETTER from a real old-timer next greets our eye, and we thereupon welcome Ortho Powell, 58, into our magic circle. It is with real pleasure that we welcome the old pusher-pilots. Hush—let us hear what Mr. Powell has to say:

Way back in 1910, *may heaven preserve us, I sat out on the prow of an imitation Curtiss pusher. It was more or less propelled by a four cylinder Maximotor, purported to give* 60 *genuine horsepower, but really giving only a stingy* 35 *goat-power.*

Since 1917 *I have reformed, but I still have a hankering for the old racket that can only be satisfied by climbing on board of another wind jammer—preferably one in which I can keep warm. It was sure breezy out on the quarter-deck of the old pushers—and I don't mean maybe—but we got a lot of kick out of it just the same.*

Once the flying bug bites you, it's all off. The virus remains in your system for the rest of your life. While it's a good 14 *years since I adorned myself with wings, yet I long for the breeze-buggy and all that goes with it—even down to the sore spots and bruises.*

I am now a resident of Kansas City, Mo., but at the time that I had the fever, I lived in Chicago, where a lot

(*Continued on page 122*)

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⅛" sq. 36"	8 for 5c	¾"x1"x6"	1c
¼" sq. 36"	8 for 5c	2 oz. Colorless Cement	15c
½" sq. 36"	8 for 5c	Light Mino 21x31,	3 for 10c

Add 10c for Postage and Packing
Send 2c stamp for price list

DALLAIRE MODEL AIRCRAFT CO.
10140 Croculawn Ave. Detroit, Michigan

Air Mail

(*Continued from page* 90)

historic records during the past twenty years. It is a machine with seven cylinders having a bore of 4⅜ inches and a stroke of 4⅞ inches. Its rated horsepower was 53½ at 1000 R.P.M. but it developed 70 and made 60 miles an hour.

It was the first engine of this type made by what is now the Indian Motorcycle Company, and was based on the French 50 h.p. rotary Gnome engine of that period. The machine was presented to the Smithsonian by Ovington after a long aerial career, during which Ovington says it never stopped with him in the air, citing this as a notable tribute to the motors of those early days.

During the Twentieth Anniversary Celebration, Dean Smith, one of Admiral Byrd's Antarctic flyers, retraversed Ovington's original route in a 575 h.p. Hornet Pilgrim plane, carrying 15,000 souvenir letters which were distributed in the stream of 1,000,000 pieces of mail traveling every twenty-four hours over American aerial lines.

Night Bombing

(*Continued from page* 80)

denly there is a thunderous explosion near by and we rush underground. Above us the ground is trembling under the impact of exploding bombs. We gaze at one another, shrug our shoulders and light cigarettes. Every one of us knows what has happened and what is happening.

Squadrons of English light bombing planes have followed leisurely along in the wake of the returning Gothas. They waited until the field was lighted and most of the big birds had landed, and now the fireworks are taking place! Many of our giant bombing planes, standing helpless upon the field, will be wrecked together with their crews. Some of our hangars will be demolished, and a terrific machine gun fire from low altitudes will play havoc among the unfortunate ground crew who set out the flares. Just an old British custom!

* * *

ANOTHER night has arrived, and there is strategy in the atmosphere! Somewhere in the heart of a distant forest is a natural meadow that has been secretly transformed into a special airdrome for the Gothas. It costs a lot of money to build a Gotha, and the German high command becoming vexed at the regularity with which the hangars of these winged elephants are being bombed, has decided upon this precautionary measure.

This is going to be a good joke on the British. The Gothas will bomb England tonight, leaving from the Ghent airdrome, but instead of returning to our field they will fly to the secret one. It will be their first night there. Naturally, the British will bomb us while our giant planes rest securely in the heart of the forest.

Well, anyhow, the high command thinks the joke will be on the *British*—but those of us who are to remain at the Ghent airdrome to dodge English bombs are having our doubts about it!

Not much use trying to fool our adversaries by lighting flares at a short distance—say a quarter of a mile—away from our field. Some of those Royal Air Force flyers have visited us so often that they could bomb us with

(*Continued on page* 128)

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1/32 x 1/4	$.01	6 for	$.05
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1/16 x 1/4	.01	6 for	.05
1/16 x 1	.04	8 for	.30
1/32 x 1/2	.02	6 for	.10
1/32 x 1	.05	8 for	.35
1/8 x 1/8	.01	6 for	.05
1/8 x 1/4	.02	6 for	.10
1/8 x 3/8	.02	6 for	.10
1/8 x 1/2	.02	6 for	.10
1/8 x 1	.06	6 for	.33
1/4 x 1/4	.03	6 for	.15
1/4 x 1	.07	3 for	.20
1/2 x 1/2	.07	3 for	.20
1 x 1	.18	3 for	.50

Sheet Balsa
36-inch Lengths

1/32 x 2	$.05
1/32 x 3	.10
1/16 x 2	.06
1/16 x 3	.10
1/8 x 2	.07
1/8 x 3	.12
1/4 x 2	.11
1/4 x 3	.19

Propeller Blocks

5/8 x 1/2 x 5	$.01½
3/8 x 3/4 x 7½	.02
1/2 x 3/4 x 6	.02
1/2 x 3/4 x 5	.01½
1/8 x 1 x 8	2 for .05
3/4 x 1 1/4 x 10	.04
1/8 x 1 1/2 x 11	.06
1 x 1 5/8 x 12	.08

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1 x 1½	$.25
1 x 2	.29
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2 x 3	.65
2 x 6	.95

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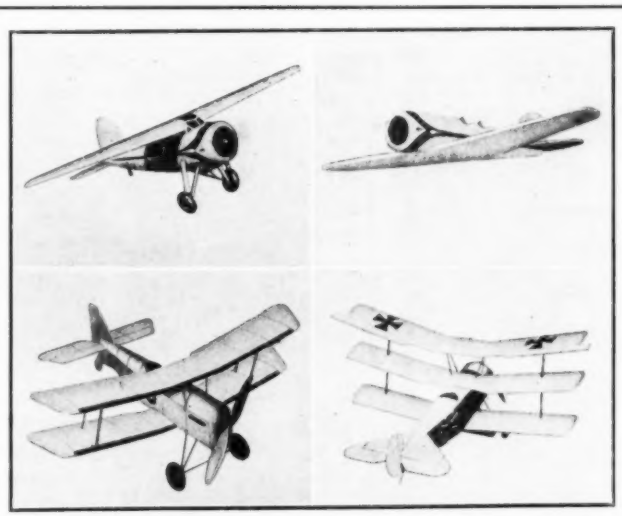
Sheet 20½ x 24 ..... $.05



Lockheed Vega, 15 inch wing span. Lockheed Sirius, 15 inch wing span.
S. E. 5. British Pursuit, 15 inch wing span. Fokker Triplane. 15 inch wing span.
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408.8 M.P.H.

(*Continued from page* 85)

parted by the ship, but is set into a condition of violent vibration. The bullet whistles and the artillery shell howls in free flight, and when we start approaching projectile speeds, we can expect a much greater disturbance from the larger mass of air broken down by the ship.

On a rough estimate, about 35 per cent of all the heat produced in the engine must be dissipated to the air through the radiator. In the case of a 2,350 h.p. engine, this heat amounts to approximately 600,000 heat units per minute. If this still means nothing to the non-technical reader, then our nearest practical comparison will show that this heat will warm up 300 tons of water per minute through a temperature of one degree or it will be sufficient to melt more than two tons of ice per minute—which is considerable heat.

We don't see how this condition can be improved by any type of engine now known to engineering science. If an internal combustion engine is used, as above, then we will always have jacket cooling difficulties. If a steam engine is employed, then we will have the same amount or even more heat to dispose of through a condenser. The only answer, when we get down to cold facts, is a brand new type of heat engine which applies more heat to the job and which rejects less heat to the atmosphere.

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Boy Scouts

(*Continued from page* 94)

flight instruction in a glider which is hung by shock cord about 8 inches above the ground, and headed into a fair breeze. The set-up amounts to an outdoor wind tunnel. Except for the fact that he is suspended from a scaffold, the student for all practical purposes is actually flying.

The glider changes position in response to the controls as though it were floating in thin air. Strapped in the seat, the aerial tenderfoot quickly learns to keep the wings level by use of the ailerons. He works the rudder to keep the glider headed in a given direction like a weather-vane.

After three or four hours of consistent training in the "sling," correct use of the controls becomes automatic. Every coordinated movement has sunken deeply into his sub-conscious mind so that in a moment of nervousness on his first flight he does the right thing without conscious thought.

As the glider is hung with elastic shock cord, there is a slight rising and

(*Continued on page* 128)

Q & A

(*Continued from page* 102)

QUESTION:—Anton Schmeling, Canton, Ohio. *What are "wing sections" and how are they employed on the wings? These sections are given names and numbers and it would also be of interest to understand how these are derived.*

Answer:—A WING section is a view of the wing, showing its thickness and the curvature of the top and bottom surfaces, just as though the wing were sawed through and we were viewing the cut surface from the end of the wing. There are a great variety of such wing sections, different relative thicknesses and different curvatures for the top and bottom surfaces, each of which gives a decidedly different performance in flight.

In the accompanying diagram, we show three typical wing sections. First, is the old double cambered thin wing section (A), often called the "skyhook," from its hooked outline. Second is a more modern section (B) with a flat—or nearly flat—undersurface and a well cambered upper surface. This type permits of stronger wing beams than the first section, and, on the whole, gives better performance.

Third, is a recently devised section (C) with both top and bottom surfaces convex. This gives still more room for the structural members and it first came into use when the self-supporting cantilever wings became prominent. It is used extensively on soaring gliders and on large cantilever type monoplanes—mostly for structural reasons.

The choice of any one wing section depends on several factors, such as speed or loading.

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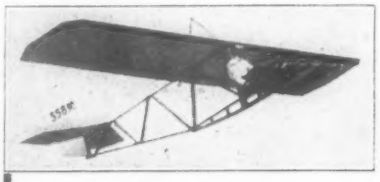

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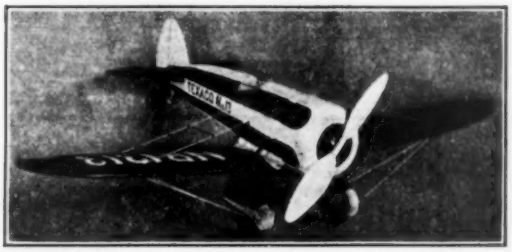

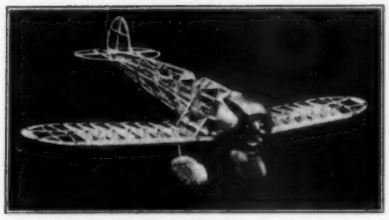

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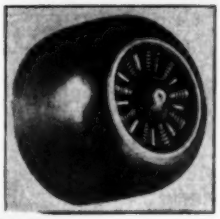
Size of Cowling—Diameter, 3 in.; Depth, 2 in. Packed in cardboard box with mounting instructions. If ordered separately, add 5c for packing and postage **50c**



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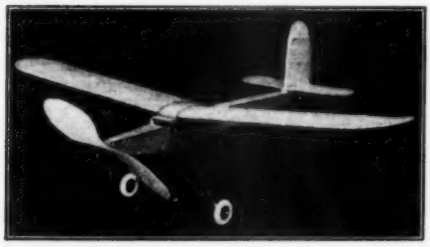

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One of the snappiest flying models in its class, proper engineering and all balsa construction does it. This plane has a double surfaced, high lift wing, 30-inch span, all balsa fuselage, extra strong landing gear to withstand the shocks of outdoor flying, and a large, wide-bladed propeller to keep it up for long endurance flights. The Kit contains complete plans and instructions, stamped ribs, large tube cement, 1 oz. bottle clear dope, pair celluloid wheels, and all materials needed to complete the model. Price..... **$1.50**

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Airy Chat

(Continued from page 116)

of other bugs held out. Here things were pretty active at the time, and there was a lot of experimenting that led to better things later on. (Check and double check—J. B. R.) I remember Smith with his ingenious ship, moulded fiber fuselage, steel wing structure and the funny two-stroke engine that jerked it through the air—hither and yon.

Then, there was A. C. Beech with his monster biplane, monstrous for that day at least, propelled by a Roberts two-cycle engine. This ship really put up a good performance and could be seen almost daily, sailing around the old Cicero field. This engine took a whole lot of winding up to get it started, but when it got started nothing could get it to stop.

Then there was Harold McCormick's old "Porous Plaster" that ran wild one day and chased all of the inhabitants around the field. How they escaped its embraces it is difficult to say.

Then we had the "Golden Stairs," a quadruplane or quintaplane that was always on the point of doing something wonderful—but never did. Then there was another McCormick production, the old "Umbrella Plane," with circular wings like a parachute or umbrella. This was supposed to be very efficient, but they could never get it to demonstrate how efficient it was.

And so on, down the list, not forgetting the two Max's and the two Ottos. Old Robinson flew the little Nieuport monoplane with perfection. Margaret and Katherine Stinson, two of the earliest birdwomen, piloted Lillie's Model "B" Wright biplane. I wonder where the bunch is today. I'd like to see them.

I would also like to see them, Mr. Powell. "Them were the days" without a doubt. There are a few of the old outfit hanging around, but the rheumatics must have got most of them by this time for they don't do much in the way of aviation.

* * *

LIFTING up another letter brings us to the other extreme. It is a letter from Lester Thorpe, age 15, who has about 15 hours to his credit. The 15-16 year old class were growing rapidly, to judge from our correspondence, but I am afraid that recent rulings by the Department of Commerce will suppress this progress—much to my regret. Lester says:

I am only 15 years old, but I have that many hours to my credit. I am afraid, though, that I will have to wait a year before the government lets me build up any more time. This is sure tough.

I don't see why they pick on us young fellows, because the older guys have more accidents than we do—at least where I am. In fact, I am about the only one who hasn't crashed so far. Another lad, 14, is ruled out like I am, and the only thing that he ever did was to tear up some bushes.

Tough lines, Lester, but perhaps things will clear up after a while. So far as I'm concerned, I am strong for the young generation and their aviation ambitions. Perhaps, if we can get a bunch of you fellows together, ranging from 12 to 16 years, and get up a petition to Congress or something, we might do something about it.

* * *

DON'T think that all of the thrills are in fiction, for at least twenty of our readers have sent in their personal experiences that discount the imaginative episodes of the writers. We have a whole lot of these stories on hand and will print them one-by-one or two-by-two in the Airy Chat columns. Now, here is just a sample experience, sent us by Robert Aiken, of Tulsa, Okla., which gives us something to think about:

I had had about five hours in the air, when I got my most exciting experience. It was on a calm hot day, a little bumpy of course, but not as bad as I have seen it on other days. We had taken off and were at a height of about 500 feet (dual control), when I saw my instructor get up quickly and beckon for me to look down over the left side.

And what did I see? Well, it was one of the landing wheels half off its axle and just hanging on by a hair! Some mechanic had forgotten to safety the wheel, when he had it off last, and there we were—scared to land and with our gas down nearly to the bottom of the tank.

To land that way was certain to stand the ship on her nose or give us a good roll. For a minute I heard the angels singing—you bet. Then the pilot waved to me to let go the stick, and he headed her northeast for the open country. I was stiff—I couldn't think of anything, I'll not deny it, but the good sense of the instructor got us out O. K. without much damage to the ship.

This is how he did it. He circled and sideslipped around the field, passing directly over and close to a straw stack several times. On the last trip,

(Continued on page 124)

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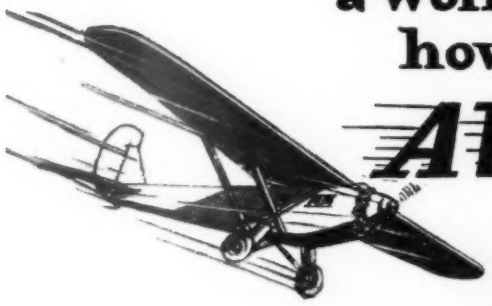

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Airy Chat

(*Continued from page* 122)

when about 100 *yards from the stack, he cut the engine and pancaked her right on the stack. There was a fierce racket, and a good smart jolt, but outside of a cracked wing tip, and a broken propeller blade, nothing serious happened. Believe me or not, it was a tame guy that climbed out of the rear cockpit.*

This same stunt, Robert, was pulled off in 1911 or 1912 by Lincoln Beachey, when he also discovered that there was a wheel missing from his landing gear. He flew from Chicago to a field outside of Libertyville, Ill., where he pancaked on a straw stack with little damage. I'll say it's not a pleasant experience, but it can be avoided by a little precaution in the first place.

* * *

WE thought that we would have a drastic change in our cover design this month so we picked out a stunt flight as a subject. This is a wing-walking performance, but the walker stands on an inverted plane which gives the stunt additional thrills, although, I suppose, it is really not much more difficult than top wing walking. Anyhow, I'd much rather be right here in my cozy chair than where we view Mr. Betz. What do you say, bunch?

* * *

WELL, well! Here is sure a novelty. We've heard them roast the old Jenny for the past twelve years in no uncertain terms, but at last a man comes forth and defends our old pet of Kelly Field. This is Charles E. Holden of Bedford, Texas, who writes as follows:

I am a young man, 26 years old, that has gone goofy about flying. I have had about 150 *hours time in the air, but it has been about three years ago. Now, I have flying on my mind again—worse than ever—but I am hardly able financially to get started.*

All the time that I have built up has been in an old army Jenny. Not once did I ever have any trouble with it, not as much as a forced landing. However, I did lend it to a friend, who had been flying since the war, and he spun in with it. No, he did not get killed, but I have often wondered how he escaped it.

I wonder if you would please help me, through your "Airy Chat," to secure another ship? What I am looking for is a real bargain. I would like to either get a Great Lakes, Fleet, or an OX Travel-Air. I would consider any of those I have just mentioned without motor.

* * *

WELL, here's where we make a three-pointer and pull up in front of the hangar. So long, fellows, see you later—CUL.

J. B. R.

Model Seaplane

(*Continued from page* 115)

must have to perform. Most model builders have had some experience along this line, and first-hand information can always be secured from some of the model builders in the neighborhood. The simplest method is to secure a block that is more wide than high.

A low pitch will work better on scale models than a high pitch type. First mark an X across the full length of the block, then drill the center hole and make it only as large as a pin. With a little practice one can push a pin through accurately enough to have the finished blade revolve true.

After marking the X, allow sufficient material along side of the shaft hole for the hub. Cut the remaining parts away and then carve. If a nose spinner is required, this is cemented on in sections and trimmed to a point.

Motor Stick—No. 12

A motor stick is used when it is desired to have a removable unit for the power plant. Balsa is used in most cases, but now and then bass is a good wood to use. When using bass the overall size can be cut down, and where a long motor base becomes necessary it is difficult to insert in through the nose make a larger one made of balsa.

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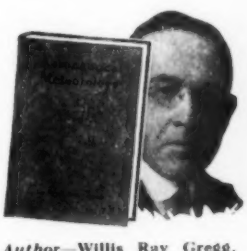

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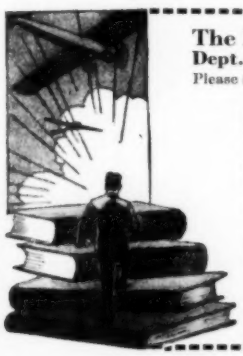

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Freddie Lund

(*Continued from page* 96)

wives can observe, "I suppose you are disappointed that it wasn't your neck. I guess, though, you are satisfied to call it a day." Then she relaxed into a grin. "But say, Freddie, that was some dive!"

"On the contrary, my dear," I observed, in the best of humor, even if my knees under the cockpit were doing Dixie, "I am going back up and finish that loop. Oh, yes, about that dive. I'll tell you about it when I get back."

I went back up and did the outside. But before I went, I had seen to it that there would be no more cable-snapping that day. I believe I have said that now I have two safety belts and each one will hold up an elephant.

When I came down, the crowd, informed by the announcer of the reason for my mad dive to earth, gave me a great hand. I believe the folks got their money's worth that afternoon. I got mine.

Well, I have been in a lot of tough places, this includes Central American revolutions, where one day you are private, the next day president and the third day shot. But I guess that afternoon at Cincinnati was about as busy an afternoon—for nine seconds, I figure it—as I have ever put in—and about as thrilling.

Flying Lessons

(*Continued from page* 106)

currents, in a milder form, have on everyday flying. We will say that we are flying over a plowed field, or over hot sand on a hot, sunny day. Under such conditions, there is certain to be strong vertical currents, and the currents will be still stronger on the edges of lakes or heavily wooded land because of the greater temperature differences existing at such places.

"As soon as we hit an upcomer or riser (1), the ship will zoom up quickly. This gives a decided bump to the passengers. Next, we fly into the downcomer of this system, as at (2), where we quickly lose all of the elevation gained — and p e r h a p s more. If we happen to hit another downcomer (3), before we have time to gain any altitude, it will drive us down so far that we run into danger of striking the ground.

"Now, it may be that we will gain some altitude by running through an upcomer (4), but this may be too late to save us. The sudden fluctuations in elevation, due to the vertical currents of air, are named from the sensation they produce—hence 'bumps.' A still, calm, hot day in summer is conducive of bumpy weather because such vertical currents are unobstructed. If a

(*Continued on page* 127)

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State of Illinois,
County of Cook
ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared B. Geo. Davis, who, having been duly sworn according to law, deposes and says that he is the Editor of "POPULAR AVIATION combined with AERONAUTICS," and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:
Publisher, Aeronautical Publications, Inc., 608 South Dearborn St
Editor, B. Geo. Davis, 608 South Dearborn St.
Managing Editor, J. H. Rathbun, 608 South Dearborn St.
Business Manager, R. K. New, 608 South Dearborn St.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) AERONAUTICAL PUBLICATIONS, INC., 608 South Dearborn Street; W. B. ZIFF, 608 South Dearborn Street; DAVID ZIFF, 608 South Dearborn Street; B. GEO. DAVIS, 608 South Dearborn Street.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: NONE.

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B. GEO. DAVIS,
Editor.

Sworn to and subscribed before me this 26th day of September, 1931.

(SEAL) ARTHUR T. PULLEN,
(My commission expires January 25th, 1932.)

Flying Lessons

(*Continued from page* 126)

horizontal breeze should be blowing, however, then the breeze frequently breaks up these currents so that the flying is noticeably smoother.

"We have less difficulty with bumps nowadays for the reason that the modern airplane wing is more highly loaded, and therefore plows through such disturbances so rapidly that the ship loses or gain but little altitude at each bump. In the old days it was different, because the wings were only loaded to three or four pounds per quare foot with the result that the ship followed the gusts up and down—jumping like a leaping Lena—until the ship was nearly shaken to pieces."

"OH, LOOK," called Bob, "the sun is shining. Do you think that we will be able to take off out on that field?"

"Yeah," was the reply. "We'll taxi out to that high strip along the north fence and take a chance with that. The soil is sandy around here, anyway, and the water will soon disappear. Let's go to it—and I've got a surprise for you this time. We're not going to fly the old open ship. I'm going to give you a tryout on that new four-place cabin job that we got out here last week, and if you are not careful with that, then it's going to be just too bad for some guy. I will promise you that."

Bob beamed with pleasure at the prospects of flying a closed ship. He knew that this was different from flying the old O. C. trainers, for the reason that the pilot was entirely enclosed and could not, therefore, be guided by the strength or direction of the breeze on his face. Bob had become almost entirely dependent upon the feel of the air, and it was for this reaon that Ed. had decided that the time had come for instrument flying and flying according to other data.

The ground crew had run the new cabin plane out on the high runway, and she certainly looked fine. "Shall I wind her up," asked Bob, and then he noticed a queer smile on Ed.'s face that made him wish that he had not been so quick in offering his services.

"No," said Ed. "She's a self-winder—just like that old jillopy of yours that is standing behind the hangar. It took the aeronautical trades a long time to put self-starters on airplanes—but they succeeded in planting a good one on this ship. You just step on her, and then let her warm up while you're sitting down on a regular seat. Get in and see, but let me take the controls first."

Bob had not been in the new ship before and he looked around in amazement at what he saw. It was more elegantly furnished than the finest motor car that he had ever been in, silver mountings and fittings, everything complete down to the smoking sets and other accessories.

Ed. pulled out the starter, and there was instant response from the engine, although the exhaust and mechanical noises had been so silenced that the noise was very much reduced over what Bob had experienced on the open ships. However, not much improvement had been made on the warming up process, and they were compelled to sit still for some little time before Ed. considered that the engine was warm enough to pull properly. Finally, after giving her a few shots, Ed. pulled her around into the wind and they took off in fine shape, in spite of the fact that the runway was somewhat soft in places so that the ship wabbled a bit now and then as she gathered speed.

After reaching about 500 feet altitude, she was flying very steadily, but in spite of the wonderful performance the ship was putting up, he still had a hankering for the old, open cockpit ships where flying was really flying. In this cabin job, it was not much different than a motor car—the same complaint made by motorists when closed sedans were substituted for the old time open touring cars.

And here we will leave them, before the controls were turned over to Bob, and before he began to master the technique of the closed cabin ship. They still maintained a fore and aft level by the horizon, as before, but the lateral balance and attitude of the ship was only indicated by the changing pressure on the body as she rocked from side to side. Of course, there were the instruments, but what pilot wishes to depend upon needles and indicators?

We Like Gliding

(*Continued from page* 115)

spectators with three more stalls and a very nice little crack-up due to structural failure. This did not exactly surprise us because we knew too much about how the crate was put together for our peace of mind.

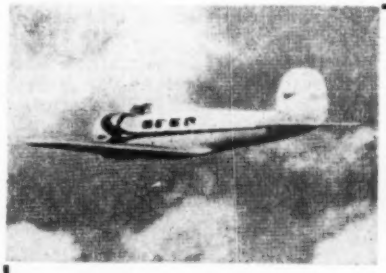
You see, we had a wooden control stick, and we had to move it sort of slow and gentlelike to prevent it from splitting. This day, Roy forgot and moved it suddenly when about ten feet high. The result was a steep dive into the Cleveland Municipal Airport.

Roy and I have had many a pleasant moment, and hearty laugh, recalling the startled expression on his face when he found he was diving toward the ground without any elevator control. In almost all our crack-ups we broke the rudder bar. In fact, to this day I can hardly look at a rudder bar without an involuntary grimace.

One day when we were flying our glider, a young man in flying clothes came along, asking us questions and giving us advice. After a while, I asked him if he could fly a glider. He said yes, and afterward I learned that he was Freddy Lund, well known test pilot and glider expert. And was I embarrassed!

On the day of the contest there was a large crowd at the airport. The first event was precision in landing, and each club was allowed two trys. I made mine, and while the landing was all

(*Continued on page* 128)



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We Like Gliding

(*Continued from page* 127)

right, the flight was not long enough to qualify. The shock cord ring slipped off too soon.

Then it was Taylor's turn. For a while it looked as though his flight would be a good one, but he had made an accidental turn, forcing him to land crosswind. There was a strong wind blowing. The result was a nose-over. The plane meanwhile did a sort of handspring, first on one wing tip, then on the nose and finally the other wing tip hitting. It was very graceful as a maneuver but very destructive as a crack-up.

Roy stood up behind the mangled wing while I looked at him reproachfully.

"Well, I didn't break the rudder bar," he said, beaming with pardonable pride. This was indeed encouraging, and upon investigation we found that the rudder bar was, indeed, in one piece though it was about the only thing that was.

Well, I'm now adding pontoons alone, for Roy has moved to California, and I hope soon to fly behind a motorboat on Lake Erie. I also expect to build a lightplane this winter.

It may be airmindedness, or it may be light headedness, but I'm in the flying game to stay.

Boy Scouts

(*Continued from page* 118)

falling due to the varying velocity of the wind. This allows some training in flipper control. Airplane pilots who have "hopped" the glider in its sling declare the machine actually feels as though it were flying.

Now for the next step. The scout is strapped in the seat and the glider is towed on the ground by an automobile. A 150 foot cable of airplane control wire connects the power plant to the plane. One or two trips accustoms the student to the new sensation and teaches him to balance his wings at slow speed. The car then is driven fast enough to lift the glider several feet off the ground. The student trips the release and lands. From ten to twenty such flights are required before the next class.

In the next training period, the student is allowed to climb to 10 or 15 feet high and learns to fly straight and steady. These flights are made off an airport and are about three quarters of a mile long. From this stage the student progresses fairly fast. After a dozen flights he thinks nothing of sailing 450 feet above the ground.

Meanwhile he learns to bank and turn without slipping or skidding. He makes S turns at first and then tries 180 degree turns. In a 180 degree landing the student cuts loose, spirals and lands in the opposite direction from the take-off. Finally he essays 360 degree turns. The 360 is a spiral that completes a circle and lands the student in the direction he took off. The maneuver calls for a master touch.

Night Bombing

(*Continued from page* 117)

their eyes shut. Anyhow, we've overworked that stunt.

They're off. Racing clumsily over the ground, our big planes crawl into the sky and head for the sea. Somewhere in England tonight—perhaps over some of the smaller coast towns — perhaps over mighty London itself, death will come hurtling down. Searchlights will fling their beams rapidly back and forth and shells from anti-aircraft batteries will splatter angrily among the Gothas. It will be a breath-taking, horrible spectacle.

This invasion of England is nothing new to us. Many of our pilots have made the trip so many times that they've lost count. As early as 1914, two German planes flew up the Thames in the daytime to take a look at London. One of them never came back.

Time is dragging and most of us are becoming restless. Some of the men wander nonchalantly off to bed. Well, anyway, the ground crew gets a decent break tonight. No flares to be lighted.

And now, a low prolonged buzz of excited conversation drifts across the field. The big bombing planes are returning! Returning—but not to us. They roar overhead and soon their sound has died away far behind us.

Five minutes go by . . . ten . . . fifteen. . . .

Nothing has happened to us yet. Evidently the winged elephants were not followed this evening. Maybe the British couldn't spare any planes for that purpose tonight. We hope so.

Twenty minutes elapse . . . thirty . . . forty . . .

We laugh in a relieved manner and stroll toward our barracks—but before we reach them a startling message is received. We now learn that twenty minutes after the Gothas had arrived at the secret airdrome, and after all lights and flares had been extinguished, British pilots flew unerringly and without hesitation to the place and bombed hell out of it!

It would seem that the English spy system was to be compared favorably with our own. At least, we seem to be having a hard time keeping secrets from each other these days.

* * *

ONCE again daylight fades away and another evening is upon us. This is going to be an awfully busy evening! We are going over to hurl eggs down upon the airdrome at Poperinghe, and I am going to be one of the egg hurlers. During the daytime I am an aerial observer, but at night our observation planes become light bombers. This is not my first visit to Poperinghe—I've dropped eggs there before on several occasions.

We are lined up ready to start. Hermann, my pilot, is seated in the cockpit ahead of me, grinning like a boy who is going on a picnic. Without a doubt, Hermann is hoping that one of the eggs will land squarely on the skull of the British gentleman who almost blew him out of his bunk last week.

Underneath our Albatross hang four bombs, each about two feet in length. The lever that releases them is in my cockpit. Naturally, these bombs do not cause as much damage as the huge ones carried by the Gothas. Nevertheless, they are fully capable of removing buildings from the landscape and mussing up the looks of the scenery.

Away we go, several squadrons, to pay our compliments to the enemy. Of course, we will meet with a hot reception, but that is to be expected. I'm glad it's an airdrome that we are after —they're big and easy to hit. I can't say as much for most other targets.*

There is no moon tonight, but there are many things beneath us which we can see. Nobody has ever been able to camouflage a river. Funny thing about rivers and streams—no matter how black the night is we can always see them. And I suppose many people who live in cities subjected to evening air raids, wonder why the authorities are so strict about having all lights out. It would be a great shock to most of them if they only knew from what great heights we can see a person light a match!

We climb to a great height, then straighten out and race through the darkness. Wonder what damage we'll do at Poperinghe tonight. Plenty, I imagine. They have some big bombing planes over there that are similar in size to our Gothas. I'll bet the British will cuss plenty if we blow some of those things to pieces. Wonder if they are expecting us. Wonder which ones among us are not going to fly back.

Far beneath us the world seems to be sleeping. Everything seems peaceful. In the cockpit ahead of me, Hermann lowers his head as though searching for something at his feet. Probably he is just making sure that he brought the beer bottle. Hermann is not content to drop bombs upon the enemy airport—he'd consider the evening wasted if he didn't also slam an empty beer bottle down to express his personal feelings.

And now, away off in the blackness ahead of us, a monstrous shaft of light darts up into the sky and sways back and forth. Poperinghe knows we are coming and the reception committee awaits!

From various points, other big searchlights are shooting their thick streams of illumination toward the clouds. It is an awe-inspiring sight. In fact, under different conditions, it could be termed beautiful.

Hermann turns toward me and makes a wry face—at least, as wry a face as one can make with goggles on. Then he lifts one hand and points towards his eyes. He is telling me that he hopes none of the searchlights will strike us in our eyes.

It seems to be a common belief among night fliers that, if a searchlight strikes them squarely in the eyes, the finish is at hand because the sud-

(*Continued on page* 132)

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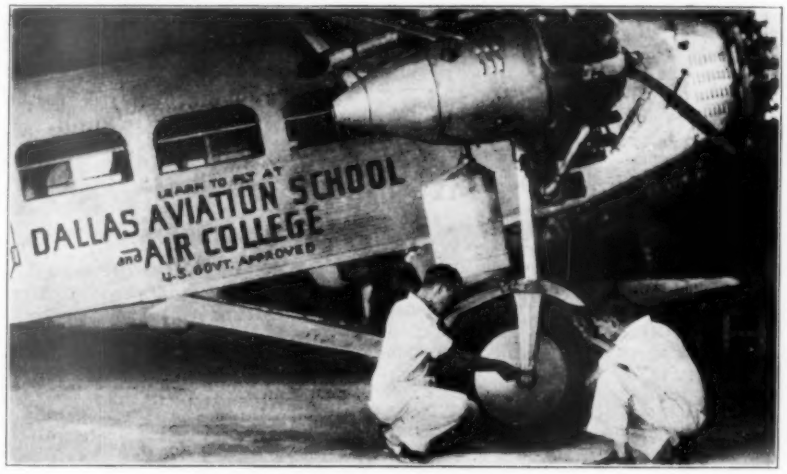

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Inspectors

(*Continued from page* 84)

that no inspector will take—not if it kills him.

Pioneering in this larger type of aircraft will necessitate a considerable amount of "by-guess-and-by-gosh" methods until we get some aerodynamics to build them by, and until this is accomplished, the department inspectors will have to act as a buffer between the plane manufacturers and the public. The department cut the payload of these big ships from thirty-two passengers to twenty-five, and the ship is now equipped with three rudders instead of one.

THERE is another bunch of inspectors in the department who do not test hop ships, but whose work is—if anything—more dangerous because of the human element involved. These are the field men who issue prospective pilots a license to fly. Many and varied are the experiences of these.

After a student pilot has been passed by his instructor, he makes an application to the local office of the department for a private license. The inspector takes his parachute, goes into the air with this so-called pilot and thereby hangs a tale.

Capt. Edison Mouton, supervisor at Oakland, Calif., was called out one morning for a flight test with one of these half-wits. Mouton took the ship into the air, and when he had sufficient altitude, turned the ship over to the student pilot. While going through his test the student put the ship into a spin, a nice flat one, and Mouton went into action. He worked on the ship for several moments but nothing happened—the ship still spun.

To stay with a ship in this type of spin is foolhardy, so Mouton turned around to the student and told him to "bail-out." These are simple words but they carry a lot of meaning to a flyer, and besides, the student pilot had another weakness besides the one in his head—he fainted. Mouton had one leg over the side by this time, and when he saw the student faint, he climbed back again and went to work on the ship.

Being an oldtimer in the flying game, Mouton understood that his one chance to get that ship under control meant standing up and trying to find the point where his weight would help the controls to right the ship. He found it when they were about two hundred feet from the ground. Mouton claims to this day that this accounts for a certain amount of baldness on top of his cranium.

The student came to after Mouton landed the ship, and wanted to finish his test, but he was sent home and told to come back in six months for his next try. Mouton thought he was through for the day, but—

Another student met him at the door of his office who said he was ready for his test and he also had an appointment. On this day, Mouton was the only one in the office to give him his test, so he started back to the field.

In his test, the youngster got into a slow turn, and before he knew it they were in a spin. This spin must have given the student the thrill of his life. He "froze" to the controls, and with the additional back pressure, Mouton couldn't move them but he did cut the motor. This seemed to wake the student up, he dropped the controls and Mouton got the ship out of the spin within ten feet of a nice big steel hangar. After this last near crackup, Mouton hung up his "out to lunch" sign and went home for the day.

ANOTHER inspector, whose name the author is not going to mention, had a woman student in the air for her test. The ship belonged to the young lady in question and cost $12,000 in coin of the realm. The inspector noticed a stream of smoke coming from around the nose of the ship. He turned around to tell the young lady to drop the controls, but she saw the smoke before he did.

As he turned around, she left the ship and her parachute opened on schedule. Seeing no reason why he should stay and fight it out, he "bailed-out" after her, and when they were about a thousand feet below the ship it blew up. If the young lady had stayed with the ship, the inspector would have stayed too. He reasoned that he could have sideslipped the ship into the airport and put the fire out. If he had tried this stunt it would have been just too bad for both of them.

An inspection of the ship after the explosion, or what was left of it, showed that the gas tank had been leaking for days. Part of this information was obtained from the wreck and part from a dumb mechanic. The young lady afterwards admitted that she had just given in to a hunch when she left the ship and the inspector is now a firm believer in hunches—from then on.

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Hangar Tales

(*Continued from page* 103)

some time next week.' I got that ship home okey."

"The tightest place that I have ever been in," explained Lefty, "was when I took a new stunt-man up to do his tricks on my plane at an air-circus. I did not know the man, but agreed to take him up in my plane when the crowd got restless waiting for the next race.

"This man went through the usual series of stunts, such as walking the top wing, sitting on the engine cowling, etc. These he did very nicely, but after a time he dropped a trapeze from the landing gear, climbed down one rope to the bar and gave the crowd a real thrill by his gyrations and gymnastics. The wind made the fifteen foot trapeze trail back, and I'll tell you it was enough to turn hair grey just to watch that boy.

"When he started to climb back up the rope, he did not have enough strength to pull himself up—he had worked so hard. There he was, with the wind pulling at him, and unable to climb up the rope. And there I was with a man hanging to my landing gear and not knowing how long he could hang on. I tell you it was awful.

"I thought that perhaps the boys on the ground could get one of the planes, and by flying under him, maneuver into position so as to pick him up. I knew that this would be very difficult —if possible at all. I then decided that the river offered the best solution.

Night Bombing

(*Continued from page* 128)

den shock causes them to lose all control of their plane. Maybe it's just another superstition. Maybe it isn't. We of the air forces have many superstitions. Even Richthofen won't allow anyone to photograph him in his flying togs.

Beneath us, and directly ahead, a terrific flash of lemon-colored flame lights up the ground for an instant. One of the planes in advance of us has dropped an egg. More eggs land, and something is burning down there! It makes a beautiful target so, as we roar above it, I grasp my lever and release all bombs at once.

The searchlights begin to sweep the sky feverishly. One or two of our companions have already been picked out by these huge eyes, and the air about them is filled with bursting anti-aircraft shells. It is interesting to see the pilots try to scamper out of the bright beams. I say "try," because it is almost an impossibility to elude these lights by falling, diving or performing any other sort of aerial acrobatics.

A couple of shells, undoubtedly intended for one of the acrobats, explode uncomfortably close to our own Albatross and add much to the evening's entertainment—as far as we are concerned. Hermann and I can go home now if we wish—we've dropped our eggs—but Hermann isn't ready. Not until the beer bottle is hurled!

Back over the airdrome we go—and all at once we feel terribly conspicuous. We are in the center of an enormous splotch of light, and more of it seems to be arriving from all directions. Caught in the searchlights!

A feeling comes over me similar to stage fright. Or is it embarrassment at suddenly becoming the center of attraction? At any rate, I feel far from flattered by so much attention.

And here come the fireworks! We are in the midst of a sea of flame and noise. The Albatross lurches and sways like a tiny boat in a storm. Perhaps it is caused entirely by the force of the detonations about us. Perhaps much of it is due to nervousness on the part of Hermann. For, after all, this is the first time he has been caught in the searchlights.

But he realizes two things: First, so long as he doesn't dive there is no danger of any of the lights striking us squarely in the eyes. And, second, that the only sure way to elude these lights is to fly away until we are out of their range. So off we scamper toward home with British shells keeping us company.

In the front cockpit Hermann turns and lets out a squawk that can be heard above the roaring of our propeller. That squawk contains a note of anguish—and I immediately realize what the trouble is. He has just remembered that, in the excitement, he forgot to throw his beer bottle.

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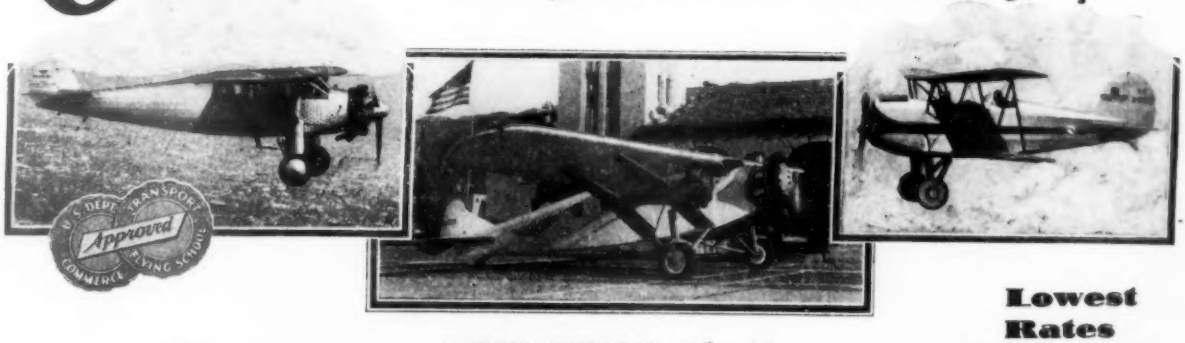

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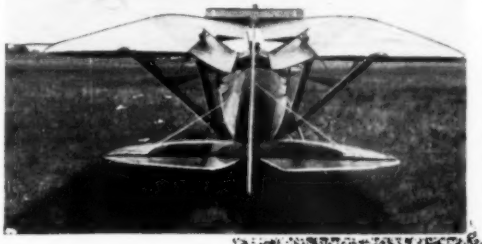

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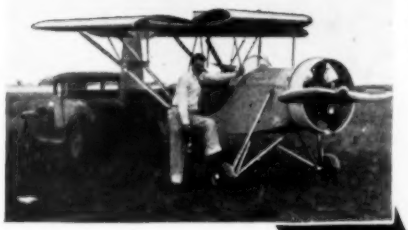

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